AMERICAN MACHINIST

A JOURNAL FOR MACHINISTS, ENGINEERS, FOUNDERS, BOILER MAKERS, PATTERN MAKERS AND BLACKSMITHS.

VOL. 2, No. 15.] NEW YORK, SATURDAY, AUGUST 16, 1879. [$3.00 per Annum.
SINGLE COPIES, 6 CENTS.

Autumn Industrial Exhibitions.

CINCINNATI, LOUISVILLE, CHICAGO, ST. LOUIS, NEW YORK, PITTSBURGH, AND SAN FRANCISCO.

The improvement in general business, and a growing appreciation of the great value of well conducted industrial exhibitions, have given an impetus this year to the organization, in several industrial centers, of extensive displays of the products of skill and enterprise Thus are the producer and the consumer brought together, in the most favorable way to become acquainted with each other's wants and inclinations. Mechanics, inventors, and artisans of every grade find in these extensive fairs an exceedingly valuable field of special information; to take advantage of which those most progressive will make pilgrimages hundreds of miles. The fall of 1879 promises to be unusually rich in large and well planned industrial exhibitions. These are to be held in New York, Cincinnati, St. Louis, Chicago, Louisville, San Francisco, and Pittsburgh.

CINCINNATI INDUSTRIAL EXPOSITION BUILDING.

The Seventh Cincinnati Industrial Exposition, which opens September 10th, and closes October 11th, is expected to surpass in variety and magnitude all other expositions held in this country, except the Centennial in Philadelphia. The great success of former Cincinnati expositions has led to the erection this year of magnificent permanent buildings, which (the announcement is made) for spaciousness, architectural beauty, and general adaptation for exhibition purposes are no where equaled in this country.

Our illustration herewith will give a limited idea of this grand edifice, which represents a value of *one million dollars*.

This exhibition is a public institution, guaranteed by subscriptions, it not being conducted for speculation or for private emolument. It is managed by a board of fifteen commissioners, appointed by the Chamber of Commerce, Board of Trade, and Ohio Mechanics' Institute. The management is gratuitous, and the amounts obtained beyond current expenses have been turned into the building fund.

It is proposed, hereafter, to hold a regular exhibition every year. Some new features have been decided upon by the Board which will be introduced this fall. The exhibits are divided into sixteen departments. Department A is for machinery, and department B for agricultural tools and machines.

These departments have over 60,000 feet of exhibiting space and 600 feet of line shafting. Power will be supplied this fall by a Brown Automatic Cut-off Steam Engine of over two hundred horse power. The feed water for the boiler will be delivered through a Victor Feed Water Heater and Purifier.

Ample preparations have been made for the display of machinery. To those who are acquainted with former Cincinnati industrial exhibitions it is unnecessary to remark, that this department has been one of the most noted and attractive features of the fair. The managers claim that Power Hall, in the new and permanent buildings, is the most complete and extensive of any for such purposes ever erected in this country with the single exception of the Centennial.

The machinery department is divided into eighteen classes, as follows:

CLASS 1.—Steam engines, boilers, and steam hammers.

CLASS 2.—Steam boilers and engine fittings, including heaters, governors, safety valves, steam and water gauges, low and high water alarms, grate bars and appliances.

CLASS 3.—Water wheels, steam pumps, and other hydraulic machinery.

CLASS 4.—Locomotive engines, electric engines, air and caloric engines, gas engines, and other prime movers and motive powers not included in classes 1 and 3.

CLASS 5.—Machinists' tools and general metal working machinery.

CLASS 6.—Wood working machinery.

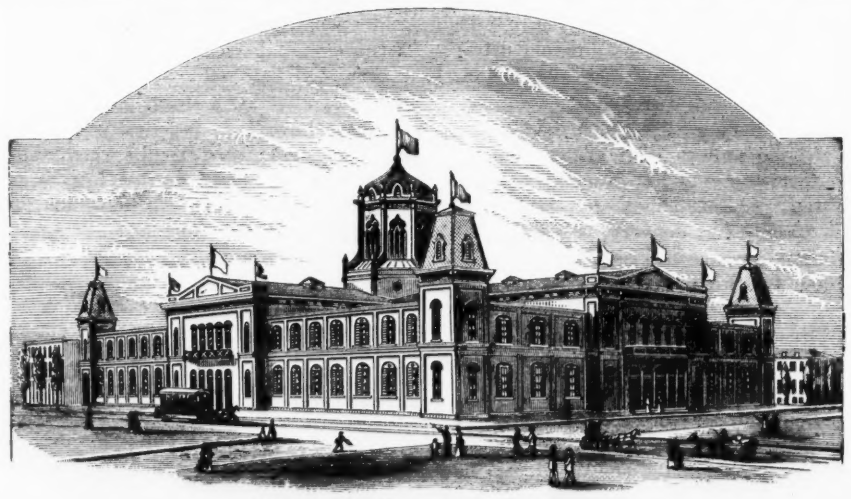
CLASS 7.—Printing, stereotyping, lithographing, engraving, book binding, paper bag, paper box, paper folding, cutting and tag machinery, and appliances.

CLASS 8.—Sewing machines.

CLASS 9.—Cotton, woolen, hemp, and rag machinery.

CLASS 10.—Distilling and rectifying mach'y.

CLASS 11.—Pressure blowers, power fans, bellows, air pumps, &c.



LOUISVILLE EXPOSITION BUILDING.

CLASS 12.—Hoisting machinery.

CLASS 13.—Boot, shoe and leather machinery.

CLASS 14.—Washing machines, wringers, crimping machines, mangles, ironing and clothes drying apparatus.

CLASS 15.—Tobacco and cigar machinery, molds, &c.

CLASS 16.—Miscellaneous machinery and appliances.

CLASS 17.—Marine and submarine diving bells, models, life saving apparatus, buoys, &c.

CLASS 18.—Fire engines and apparatus.

Two hundred and seventy-eight gold, silver and bronze medals will be awarded in this department.

A prize of $100 will be awarded the best smoke-consuming device attached to a steam boiler. From a circular issued for the information of exhibitors, we learn that articles competing for premiums must be receipted for by the Secretary, and be in position on or before September 10th. The driving engine will be in operation one week previous to the opening of the exposition. All machinery must be in running order on the day of opening. No article can be entered unless previous application has been made on the printed form. No charge is made for space, but exhibitors pay an entrance fee of $2 for each premium competed for. Articles for competition must be of American manufacture. The jurors for the examination of the exhibits will be wholly disinterested Exhibitors shall circulate no advertisements, except as to their business and from their own space, except by special permit. No article on exhibition can be removed from any department during the exposition. No second class awards are to be made, except in the horticultural and tobacco departments. One line of shafting runs at 200 revolutions per minute, and the other for wood working machinery at 300. Driving pulleys will be furnished exhibitors at cost.

The Seventh Annual Louisville Industrial Exposition opens September 2d, and closes October 18th. A grand building has been erected for it on the corner of Fourth and Chestnut streets, an illustration of which appears herewith. Certificates of honorable mention will be given to such inventions as are deemed worthy, and to those displays which are most creditable, but all articles will be received for exhibition only. Premiums will be awarded only by special agreement between the directory and exhibitors. Every facility will be extended to exhibitors to sell articles exhibited. No charge is made for space. Machinery and articles from a distance, marked and consigned to the "Louisville Industrial Exposition," will be received and cared for according to instructions from the owner.

If the owner or agent be not present at the opening of the exposition, the directory shall have the right to unpack at the owner's risk, and to exhibit the articles sent for exhibition.

The main lines of shafting from which power will be furnished for operating machinery are two and fifteen-sixteenths inches in diameter, and will be furnished with two twenty-four inch pulleys, nine-inch face, to every sixteen feet of shafting making two hundred revolutions per minute. Driving pulleys of any required diameter, also countershafts, pulleys and belts and hangers, will be furnished to exhibitors at cost, if timely arrangements for them are made. Pulleys, for the main lines of shafting, if furnished by exhibitors, must be accurately balanced and

must have the exhibitor's name plainly marked on them, and should be received before August 20, to enable them to be put in place on the shaft without unnecessary labor and inconvenience.

The machinery of the Louisville Exposition will be driven by a Buckeye Automatic Cut-off Steam Engine.

The seventh annual Inter-State Industrial Exposition of Chicago will open September 3, and close October 18. The previous fairs have attracted an average attendance of not less than 400,000 persons each year since the commencement. The fairs have steadily improved, and this year a grand display of industrial products from all sections of the country and an increased attendance of visitors may be expected. The classification embraces ten departments. Department B is that of general machinery and machine tools. It is divided as follows :

Sec. 1. — Hydraulic machinery, including pumps of all descriptions. Mill machinery and fixtures.

Sec. 2.—Engines, Locomotives and other motors and steam generators. Fire engines and fire extinguishing apparatus. Railway and car fixtures and vehicles.

Sec. 3.—Wood working machinery and machine tools.

Sec. 4.—Iron and other metal working machinery and machine tools.

Sec. 5.—Mining tools and machinery.

Steam power, shafting, and space are furnished exhibitors free of charge, but they must provide the necessary counter-shafts, pulleys and belting. There are four main lines of shafting. The first, driven at a speed of 130 revolutions a minute, will operate all iron working machinery; the second, driven at 150 revolutions a minute, will operate the wood-working machinery; the third, driven at 150 revolutions a minute, will run miscellaneous machinery, and the fourth, moving at 130 revolutions a minute, will drive the agricultural machinery. The driving engine will be in operation five days previous to the formal opening, and exhibitors of machinery must be fully ready on the opening day. The fair will be open each day from 8 A.M. to 10 P.M., and the managers have wisely placed the entrance fee at 25 cents. We are of the opinion that none of the industrial exhibitions should ask any higher rate of admission.

If, as it is presumed, one prime object of these autumn exhibitions is to educate mechanics, the price of a ticket should be low enough to permit the great body of artisans to make frequent visits without spending the best part of their wages for admission.

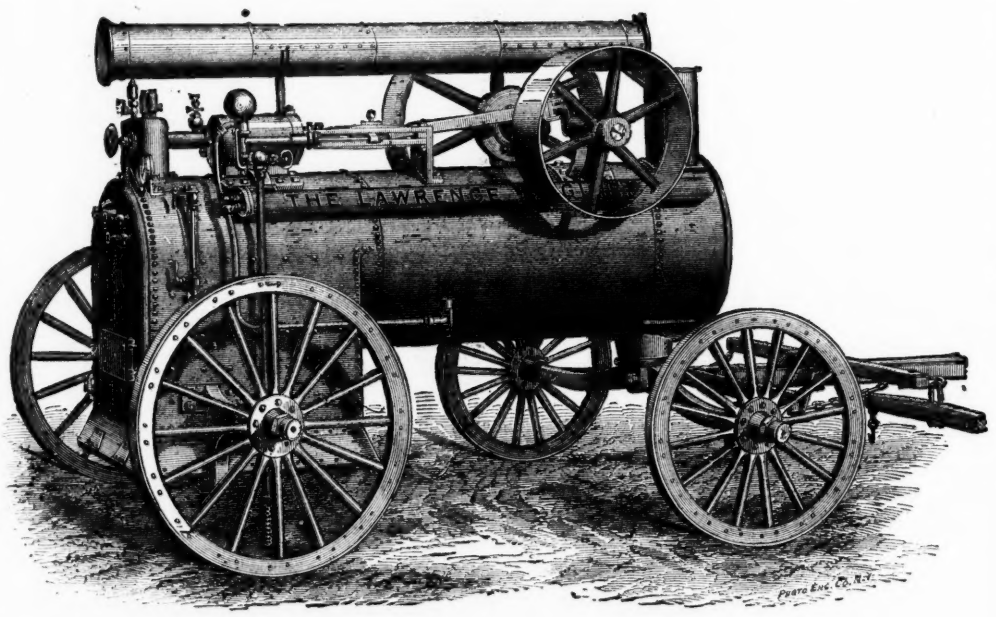
The Nineteenth St. Louis Fair and Exposition of the St. Louis Agricultural and Mechanical Association opens September 22d and closes October 11th. A full line of attractions is offered, but we will only refer to the machinery department.

There are fourteen classes, of which six are "grand displays." For the largest, best and handsomest display in each of these six classes a diploma and a gold medal, or a diploma and $100, will be awarded. The grand displays are: class A machinists' tools, B wood-working machinery, C steam engines, D steam pumps, E milling machinery, F railway supplies. Machinery Hall is 248 feet long and 58 feet wide with an annex 95x50 feet. The main shafting is 220 feet long and runs at 130 revolutions. Two lines of counter-shafting together 240 feet long run at 130 turns. All machinery entered for competition must be put in practical operation when required by the directors. In all classes where the articles exhibited are not of a superior character, the Examining Committee are positively prohibited from giving any premium or distinction of any kind.

One feature of the St. Louis Exposition is especially commendable. The managers announce that "*no invention or products of convict labor will be received for exhibition or competition.*" This is the proper stand for all our Industrial Exhibitions to take. None of them should aid or encourage the squeezing of free mechanics down to the 40 cents a day basis.

The 48th National Exhibition of the American Institute opens in New York City September 17th, and will probably close some time in November. The building is situated on Second and Third Avenues between 63d and 64th streets. The Exhibitions of the American Institute have always attracted throngs of people from all parts of the Union, and have been kept open several weeks longer than any other. Located in the great metropolis, the large number of visitors is not a thing to be wondered at; indeed it would be a matter of wonder if an Industrial Exhibition of any respectable magnitude in the city of New York should fail to draw a crowd of visitors. The management of the American Institute has been severely criticised for several years past (and not without reason), but its annual fairs are a source of instruction and entertainment not easily to be found elsewhere. Unusual facilities are offered this year to exhibitors intending to operate machinery, or practically illustrate any process of manufacture. These manufacturing processes always attract more attention than any display of a finished product.

The Fourteenth Industrial Exhibition of the San Francisco Mechanics Institute opened August 5th, but we are not informed as to its closing. The Pacific Coast has made rapid strides in a mechanical direction within a few years, and gets up displays of machinery, tools and other products of industry that compete very favorably with the best Eastern manufactures.



The Third Exhibition of the Pittsburgh Exposition Society opens September 4th and closes October 11th. A large and commodious building was erected for the purpose by this Society, and the grounds are tastefully and beautifully laid out with lawns, flowerbeds, fountains, &c., and well illuminated at night.

A limited quantity of steam and water power will be supplied gratuitously. There are two main lines of shafting, one driven at 120 revolutions a minute for heavy machinery, and the other 240 revolutions for wood-working and miscellaneous machinery.

Driving pulleys, counter-shafts and belts are furnished exhibitors at cost if applied for in time. Special concessions will be made for the sale and delivery of exhibits in the buildings and on the grounds.

The American Machinist will be represented at all of these seven Exhibitions, and our readers may expect to hear something of what is displayed at each one of them.

Mr. Frank H. Norton, in his little book, entitled "The Rights and Wrongs of Labor," says the people of the ancient city of Sidon, in Phœnicia, situated at the eastern extremity of the Mediterranean, "cast mirrors of glass, excelled in the manufacture of drinking vessels of gold and silver, and were acquainted with the use of the blow pipe and the lathe."

Meteor fragments are getting to be a feature of Western fairs.—*N. Y. Coml. Adv.*

Glad to hear they are having meatier fragments. The historic oyster in hot water is getting played out at fairs and in the papers. *Boston Coml. Bulletin.*

Engine Proportion and Construction—Piston and Stuffing Box Packing.

Editor American Machinist:

Various arrangements have been used to diminish wear and consequent leakage, partly arising from the adoption of high piston speeds. In Europe, where the piston rod of horizontal engines often passes through both cylinder heads, and is guided by a cross head at each end, the solid phosphor-bronze piston has sometimes been used in cylinders up to about sixteen inches diameter. These pistons generally have a thickness of one-fourth their diameter, made quite light and partly sectional for adjustment. They have a series of small grooves, four or five in number, turned in their edge ; the grooves are supposed to be filled by condensation, these acting as packing; but this piston has yet to be thoroughly tried.

The English use a solid cast-iron piston with two or three small square steel rings sprung into the edge, but with these lubrication must be sure and perfect, or trouble will at once be at hand from serious and rapid cutting; but the piston receiving the most favor from English engineers to-day for cylinders up to thirty inches diameter, is the one with two cast-iron rings turned eccentrically so as to have a difference of about four to one between the thick and thin sides. The thin side is tongued and grooved together, and is not less than $\frac{3}{8}$in. thick. Both rings are reinforced on the *inside* by steel bands, and are fitted carefully to a central junk ring ; they give no trouble and are very substantial.

Self-acting steam packing for piston has not a very strong foothold in any of the old countries yet, but the good ones will probably take their place there in due time, and this turns us to the subject of self-acting steam packing in *this country*.

During the past twenty-five years, many patents have been granted, covering different modes of affecting a steam packing. Some of these have been practically introduced, and have shown good results when properly cared for; and when I say this, I do not wish my steam packing friends to think I am writing down their mechanical principle. Far be it from my thought to condemn any American invention, for the Americans are certainly the pioneers in this direction.

When the self-acting steam packing was first introduced, the steam pressure admitted to rings was allowed to be too great, and every cylinder in which it was used was worn to the form of an hour-glass, largest at the ends and small at the center, owing, of course, to the high initial pressure at the ends, and the falling off of said pressure by expansion at the center.

Cylinders with the common spring packing get largest at the center, as at this point the piston reaches its highest velocity, due to crank motions, but not to an injurious degree. Makers of steam packing aim to neutralize the irregularity of wear, and have well nigh overcome the original difficulties by so arranging the steam openings to rings, that the initial pressure is much reduced and consequently retains nearly the perfect form of cylinder.

But the greatest difficulty met with in the matter of pistons is the *everlasting heavy casting*. As long as we American engineers refuse to guide the piston-rod for long stroke horizontal engines at both ends, we certainly ought to make our pistons as *light* as possible; even of cast-iron they generally can be 25 per cent. lighter than the majority *are*, and if the steel casting, now plentifully made in this country, was to be substituted, a saving of 50 per cent. in weight could be made. I sincerely hope the day is not far distant when cast-iron *pistons* and *cross-heads* will bow themselves out for all time.

In examining and caring for the steam packing the openings in face of piston, for the admission of steam, must be kept free from grease and dirt, otherwise the packing is rendered useless, and we have a leaky piston at once.

The natural twin of the piston-packing is the stuffing-box or piston-rod packing. In making a stuffing-box and gland one thing is necessary in all cases, and that is the lining of box and gland with brass at every place where metal comes in contact with the piston-rod ; this is a sure guarantee against cutting, unless the packing is shamefully neglected.

The cavity for the elastic material used for packing should not be less than one and three-fourth times diameter of rod, and two and one-half times diameter of rod in length. The gland bearing outside of flange should be equal to one diameter of rod, but should have no more than one-half inch bearing in box; the remaining portion should be reduced in a conical form back to flange, making it at this point $\frac{1}{16}$ smaller than the end in the box; this will allow for any irregularity in screwing up the gland and will prevent any binding or undue pressure at this point. The methods of screwing up the gland are numerous, but the best is the cup-formed screw cap, because it does its work uniformly, and is easy to adjust while the engine is in motion. It is used but little on large engines, however, on account of its cost, although there are ways of making it that cost very little more than the common flanged gland and stud bolts.

Wm. H. Hoffman,
Passaic, N. J.

Portable Steam Engines.

Any one in need of steam power, for other than agricultural purposes, is apt to look with suspicion on the portable engine, as being perhaps good enough where economy of fuel is no object, but hardly suited to the workshop or mill, and not worthy of a second thought when they are to be compared with some of the better class of smaller stationary engines.

There is much truth in this, for generally the portable engine builders have seemed contented to follow the same old type, and as a consequence the market is overstocked with low priced engines, without much regard to quality; but there is really no reason why this style of engine should not be made as durable, economical of fuel, and regular in its working as the best of the stationary class.

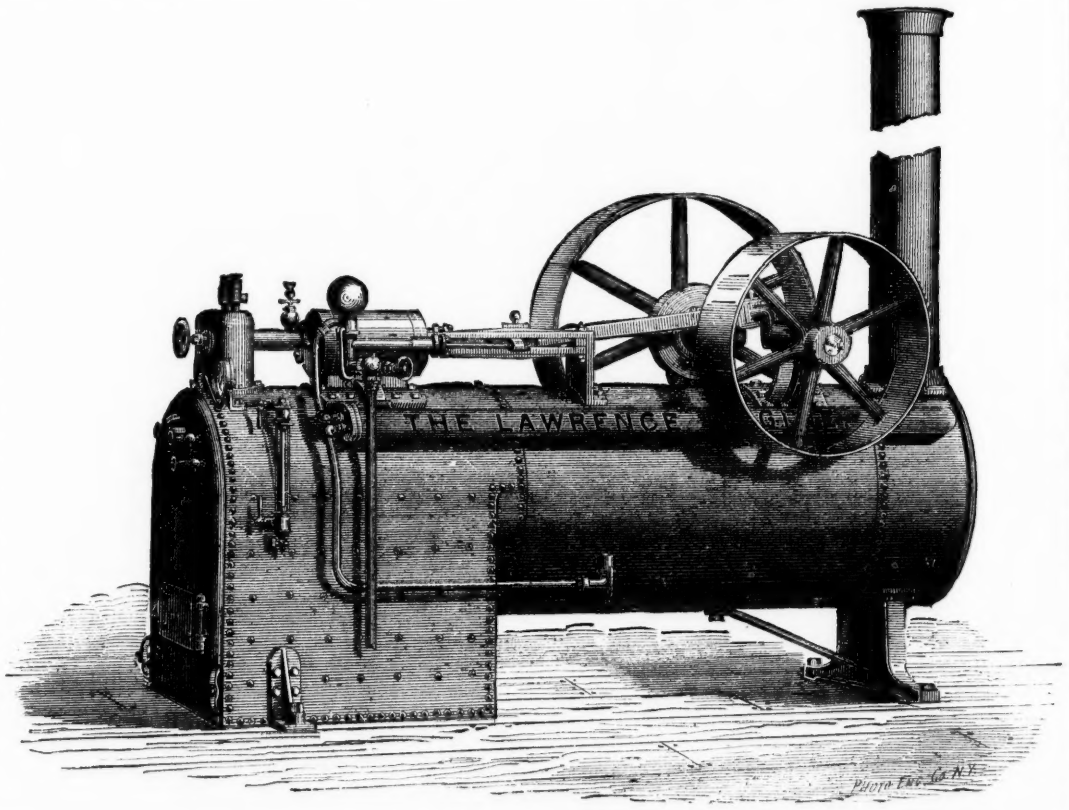
Such an engine would often be much more economical in first cost, as no expensive foundation and boiler setting are required, and could more profitably be employed in a great many places than any other style.

We take pleasure in illustrating the "Lawrence Engine," that is claimed to meet all of the requirements mentioned, which is made by Armington & Sims, of Lawrence Mass. These builders have had large experience in steam engineering, having been connected with the late Hoadley Co. from its commencement, and seem to be alive to the great

advances that have been made in the past few years, in the economy of fuel and perfection of workmanship. An interesting feature is the construction of the boilers, which are represented, in the way of a guarantee, to be of the best iron, of a high tensile strength, and which are tested at 200 lbs. per square inch. They are made of very heavy iron, thoroughly stayed, and the purchaser is assured that he is getting a thoroughly safe boiler; and when so many worthless ones are constantly exploding, this safety can hardly be measured by the few dollars over the price of so many "made to sell."

With a good boiler, having ample heating surface to meet all the requirements of the engine, the next consideration is the engine proper, which, in this case, is firmly attached to the top of the boiler, being readily accessible, and having steel crank shaft and rods with large bearing surfaces, well provided with oil cups, and with all parts well fitted, and, we are informed, of first-class workmanship. This engine is provided with an automatic cut-off regulator, which enables it to compete with the very best high priced stationary engines which work steam expansively, and to show indicator cards giving as a result as low as 22 lbs. of steam per indicated horse power, and a fuel consumption, with a boiler not covered, of about 3 lbs. of coal per horse power per hour. This is about one-half of the fuel often used in portable engines. In showing such economy, it not only runs with less fuel, but less water, less labor in attendance, and insures a more durable engine. By examining the engine it will be found that it has no complication of parts, and that it is in fact more easily run and cared for than the old style of portable. To sum up, the following special advantages are claimed for the Lawrence engine: ample heating and evaporating surface; great simplicity, they can be run by those having no experience as machinists or engineers; economy of fuel; great regularity of speed; perfection of workmanship.

These engines are built in a number of sizes, either mounted on wagons or for stationary purposes.



Engineering Popularized.

No. VIII.

Mr. Editor:

My friend Hemenway stands off a couple of weeks ago, and propounds a series of conundrums which must have worked up a corner in interrogation points. But see here, brother H., why don't you take hold and answer some of them yourself, and not merely let on you know how? It's mighty easy to stone the old hen, but why don't you lay some eggs? You are all wrong in supposing that I assume the authority to teach,—all wrong. Swap ideas! That's the idea! Come up now!

So you want some questions answered. Well, let's take the first one: "What *are* the ordinary working conditions?" Ans. The ordinary working conditions of a good automatic cut-off steam engine are supposed to be, speed 400 to 500 ft., dry saturated steam at 60 to 80 lbs., cut-off $\frac{1}{8}$th to $\frac{1}{4}$th stroke, —free exhaust, tight piston and valves etc., as every body knows. Second: "What is about 20 lbs?" Ans. About 20 lbs. in this instance is anywhere from 10 to 30 lbs., either of which values, or their intermediate, can be substituted without destroying my argument in the connection in which I used it; namely, in speaking of the said-to-be amount of interior cylinder condensation per sq. ft. of surface. Now honestly, Mr. H, would I be doing the American Machinist much service by answering such a series of questions as that,— or you by asking them? I think not.

But please next time be careful and not put words into my mouth. I never stated that any high pressure engine, small or large, would develop a H. P. to every 16 to 21 lbs. water fed to boiler.

What I *did* say was that that would be standard economy *by diagram*, and I have many that show it. Probably under the most favorable circumstances, nearly 20 per cent. must be added to account for the losses not shown by the indicator, and 50 per cent. is by no means uncommon. As a comparative measure however between two engines, the card answers a good purpose.

Now, Mr. H., I am up for instruction, and so is the public. Suppose you give us your theory, or practice, of superheating steam by means of leaky valves, and I will guarantee it will be interesting. Mind, I don't say you can't do it; but as you made the motion, you are the proper man for chairman on the Committee of Explanation. Then as to the $\frac{1}{16}$th lap. Don't you think the two solitary cases you mention are just the exceptions that prove the rule? I suspect you know of plenty of cases—I do—where such valves instead of being O. K. were decidedly N. G. Your observation is good on valve seats not being grooved by steam into the *ends* of the ports when the lap there is light. And why? Simply because steam can't well cut till it gets a *start*. So if I want to account for the phenomenon I should say that ordinarily a little score is started into the port by grit or something else, which score if it were not for the steam would soon be effaced by the friction, or would do no harm if it were not. But the steam seizes on it as a channel way, and your valve is very speedily "worser and worser," all of which can't happen at the *ends* of the ports, and is a good enough reason if it isn't the right one. It must not be forgotten too that the lubricants used have got a great deal to do with the question. Many of them,—notably tallow, contain either native acids or were rendered with acids, which fiercely attack the iron and soon reduce it to a condition like plumbago, so that the steam can cut it with the greatest facility. I don't propose to advertise the various "—olines" in market, but whatever you do don't use tallow, not even the leaf.

Finally, my brother, I haven't the least objection in the world to your saying my engineering isn't correct, though it answers my purpose first rate, and gives satisfaction to a pretty large clientage, but I would suggest that you *prove* that it isn't. Drop conundrums and *prove* it.

I notice a good deal of squirming over the matter of valve leakage, and it seems that a good many of your correspondents, Mr. Editor, don't like to admit it. Well, it so happens that my practice has led me to investigate that subject, as much as any one thing about engines; and, as a consequence, I feel pretty solid in my own mind, that a tight *working* valve is a rather rare thing to run across. I get a good deal of confirmatory evidence, too. For instance: a certain well-known experimental scientist told me, very lately, that he had had occasion to conduct a very extended series of experiments with a certain new scientific instrument he was perfecting. In the course of these experiments it became necessary for him to test it in connection with engine cylinders, and it seemed almost literally impossible for him to find an engine whose valves were tight enough to make his experiments of any value. He spared no pains to get tight valves, and even went so far as to have an engine specially re-built for him by its builder—one of the best known in this country—yet the leakage was simply "outrageous," I think he said, and he was finally obliged to abandon that line of experiments altogether. It don't do, either, to block the engine and open the waste-cocks, and then, because they don't blow, swear that the valves are tight. Valves that are tight in one position, may blow in the next, especially when a variable travel renders them liable to shoulder. The unequal expansion of the varying shapes and thicknesses of metal about the ports distorts the bearing surfaces, and a valve may be tight when the cylinder is comparatively cool, and yet blow when hot. It would seem quite probable, too, that the varying temperatures and pressures inside the cylinder should constantly alter the shape of the seats. To be sure, leakage *into* the cylinder is not *all* lost, but right here is where one of the miseries of four ported engines comes in. Just trace it through. We will say the back steam valve opens, the piston moves $\frac{1}{8}$th stroke, and cut-off takes place. From this point onward, leakage, if any, commences and increases, as the internal pressure falls, till the end of the stroke, but this leakage does *some* work. But now the back exhaust-valve opens and the scene changes, for the leakage is now not only worse than ever, from the greater difference of pressures on the two sides of the valve, but it blows right straight through into the exhaust, and is utterly wasted. I am going to display some facts and figures on this point before long.

Mr. Hoffman is giving us some most valuable papers on design, which we all hope will be continued indefinitely. Speaking of cross-heads and piston-rods, there is one good form he didn't mention. The cross-head is of cast iron, and is split for its whole length by a vertical plane through the axis of the rod. The end of the rod is chased to a thread, not too coarse, and decidedly round in the bottom. The two halves of the cross-head are bolted together, with a thickness of paper between them. The holes for the rod and the two studs which carry the gibs are then bored out and tapped, and then counter-bored a little so as to hide the thread. After taking the paper out, the two halves are pinched on the threads by three strong bolts, of which the pin may be one. By this means, the transverse strain, due to the imperfect bearing face of a jam nut is got rid of; and, while all creation can't start anything loose, yet, when you want to center the piston, or take up the gibs, you have only to slack the bolts a taste, and screw the rods or studs in or out, and pinch fast again. The studs have a hexagon collar on them to use with an open end wrench. Another advantage of this notion is that it admits of a large cross-head pin of any material, without weakening the cheeks by a large hole to put it through, since, as the cross-head comes away in halves, the pin may have a taper and shoulder, on each end, only large enough for strength. Obviously, the pin may be turned around as it wears, which is important. Where a pin cannot be so turned, flats should be filed on the top and bottom a little wider than the motion of the brasses, otherwise the joint may wear a shoulder.

Now, Mr. Editor, I am going fishing way up in Michigan for a few weeks (probably your readers are as glad of it as I am), and if any man says "engine" to me while I am gone—why, I carry a shot gun, that's all.

Wm. Lee Church

Advantages of High Speed Engines.

No. II.

BY CHARLES T. PORTER.

The development of the steam engine has moved on with the advance in our knowledge of the properties of steam, and the conditions upon which its economical use depends, and the progress of mechanical and constructive science. Its original form was the beam engine. Fifty years ago this was the only form of the steam engine known. The first locomotives were provided with beam engines, but as steam of greater density came to be employed, and the system of variable expansion came into use, involving the admission of the full boiler pressure upon the piston at the very commencement of the stroke, the radical defects of a construction which requires the force of the steam to be transmitted around three sides of a square, instead of along a direct line, and through a beam center perched on a scaffolding, and there suffering a strain equal to twice the force transmitted, have gradually been made so apparent, that not all its traditions or associations can save the beam engine from falling into disuse. In the stationary engine practise of the future, it will have no place. I pause to salute its departing shade.

The inverted vertical engine, designed and patented by Mr. Naysmith, the inventor of the steam hammer, and generally known in England as the steam hammer engine, was for a while regarded with favor; but for stationary uses it is not, on the whole, found to be a desirable form.

It is, indeed, self-contained and direct acting, but these advantages are gained at the expense of a confined and inconvenient arrangement, and the loss of the equilibrium of the reciprocating parts.

The excuse for its employment has been the small floor space that it occupies, but its advantage in this respect will not hereafter be sufficient to warrant its use on land; although at sea this seems likely to continue the controlling consideration.

The oscillating engine has passed away forever.

The use of inclined engines has taught engineers to understand why a successful steam engine must be either exactly vertical, or exactly horizontal.

There remains only the horizontal form, obscure in its origin, little accounted of in its early days, but in it lay all the possibilities of the future of the steam engine.

Boiler Attachments.

The first and most necessary attachment that we may class under this head is that for supplying the boiler with water as fast as it is evaporated. This was usually done, and is, to a great extent, yet, by a force pump, driven by an eccentric on the shaft, or attached directly to the cross-head of the engine.

By referring to locomotive and steam yacht practice, in particular, it will be seen that this old and well-known instrument for supplying the boiler with water is being somewhat replaced by an instrument called an "Injector."

Formerly, the value of this little instrument, although it is now gradually winning its way to universal favor among many engineers, had not been recognized nor appreciated, probably because the principle of its action was not generally understood, or because those then in use had not been constructed as near to perfection as the injectors that are now in use.

In a great many cases this valuable little instrument may take the place of the pump, to more or less advantage, even where the latter is now in use.

We will refer to the locomotive, for example: many hundreds—yes, I think we may safely say, thousands—have dispensed with one pump, and now carry an injector in its place. Many advantages are hereby gained, especially that of enabling the engineer to fill the boiler while the engine is standing on the side track, or in the shed, as the case may be.

In many cases, this injector is of sufficient capacity to supply the boiler with the required amount of water. Should the pump fail to do its duty, the injector is ready to start at a moment's notice, to take the place of the disabled pump, and allow the work to go on as if nothing unusual had happened.

Then, again, some locomotives have dispensed with the pumps altogether, and have substituted two injectors in their place, either one of these being amply sufficient to supply the required amount of water. Then, should one give way, which is a somewhat rare occurrence with some of the modern forms of injectors, the other injector will take charge of the work and allow everything to go on satisfactorily.

Another important point of economy is the wear and tear that the pump is subjected to, as it must keep moving while the engine is running, whether it is pumping water or not.

It seems almost unnecessary, in order to show the value of this instrument, to take into account the number of heat units that the water absorbs in its passage through the injector in doing the required work, which would otherwise pass up the smoke stack, producing no useful effect in many cases and very little in others.

Nor is it necessary to take into account the injury done to the boiler by the introduction of cold water, which is generally the case when the pump is used.

Then, again, the boiler may be filled when there is not a sufficient pressure of steam to run the engine in order to work the pumps. Should there be a sufficient pressure of steam, it would not be very economical when no other work is to be done save that of feeding the boiler.

Not only for the above reasons, but for many others that might be given, the injector is, in many cases, superior to a pump for supplying a boiler with water (I allude to locomotive and similar practice). Even if it does require more steam than is required to introduce the same amount of water with an ordinary pump, it has many advantages which over-balance this; but, as all the heat is returned to the boiler that is required to do the work, save that little which is lost by radiation, the loss is not so great but that it leaves it as has been determined, not only theoretically, but practically, a more economical boiler-feeder than the pump is; and, again, some forms are equally, if not more, reliable than a pump, as there are no valves to constantly rise and fall, or movable parts, to wear, break, or get out of order.

We have sufficiently stated the value of this little instrument, and it may now be preferable to give a description of it, and also describe the principle of its action, to those who are not very familiar with it.

One of the simplest forms of this instrument is that shown in Fig. 1. The principle of its action is as follows:

Steam escaping under pressure has a very high velocity, and, while escaping from the "steam plug," D, seems to unite with the water in the "combining tube," H, and gives to this water, which is quite heavy, a very high velocity, and sends it through the "discharge plug," D′.

The power of the water to enter the boiler comes from its *weight* moving at a high *velocity*.

The injector is so proportioned that the water, as it passes through the discharge plug, D, has a higher velocity than it would have if escaping directly from the water space of the boiler. Hence its action, so far as the necessity of overcoming the resistance of the boiler pressure, is obvious.

Now, as the steam is coming from the boiler, it enters the steam plug, D. Here it is joined by the water, which enters at J and *a*, and fills the combining tube, H; here the steam gives the water a velocity, is condensed, and a water jet is formed, which is

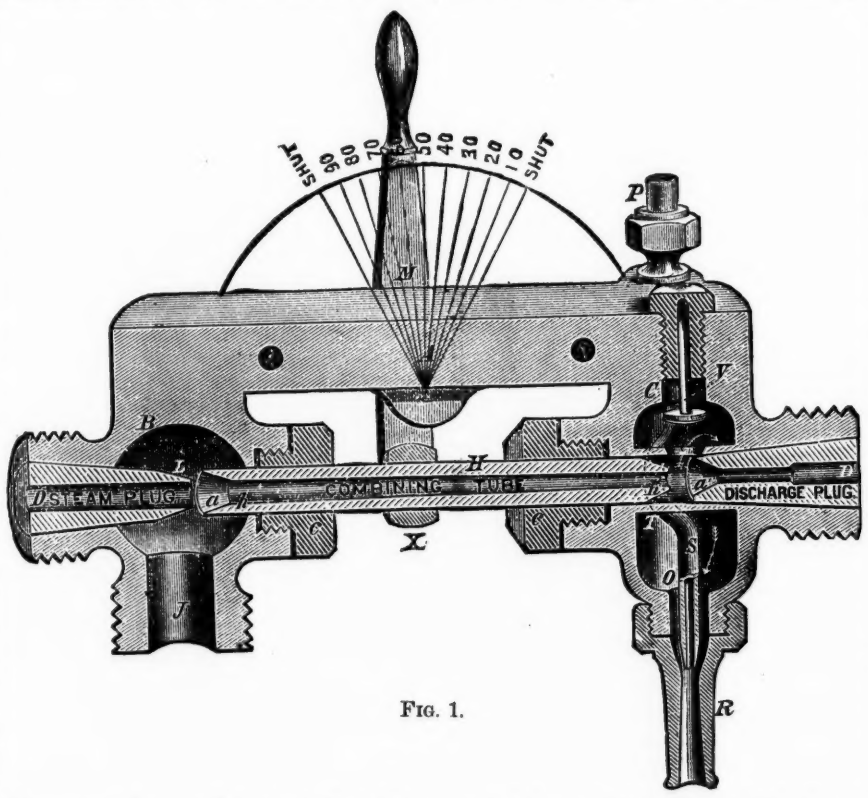


Fig. 1.

driven across the overflow space, T, and enters the discharge plug, D′; thence past a check valve, which is generally placed a few inches from the injector, into the boiler.

During the passage of the water from the combining tube at *h′* to the discharge plug at *a′*, as it passes over the overflow space, T, if too much water has been supplied to the steam, some will escape at *t*, as indicated by the arrows, and flow out of the overflow nozzle, R, for the reason that the pressure of steam is not great enough to give that amount of water the necessary velocity, in order that it may have sufficient power to overcome the resistance of the boiler pressure; hence the water and condensed steam, or mixture, as it is generally termed, must pass out at the overflow.

This will go on until we reduce the water supply. This is done by moving the lever, M, to the right, which will move the combining tube nearer to the steam plug, D, thereby reducing the supply of water until the steam can give it the required velocity; and, when this has been obtained, there will be no discharge of water at the overflow.

The injector being at work perfectly, we will suppose that the pressure of steam has been gradually increasing, which likewise increases the velocity of the water in the combining tube, until it is driven through faster than it can be supplied, and air will be drawn in at the overflow; but this is prevented by the small check-valve, V. Whenever this occurs, we are generally warned by a peculiar sound coming from the injector.

This will go on until the amount of water is not sufficient to condense the steam, and be at a less temperature than 212° Fahr., which will cause the formation of steam, which is very light, although, with its high velocity, it has not sufficient power to overcome the boiler pressure, and must, consequently, pass out at the overflow in the form of a very wet steam, so to speak.

From the above it will be seen that, although the velocity of the mixture of a temperature above 212° Fahr., or when the formation of steam takes place, is much higher than that of a mixture in which this formation does not take place, the power of the former is much less than that of the latter, "because the total actual energy is proportional to its *weight* multiplied by the square of its *velocity*."

To illustrate this in a very simple way, let the reader procure two wooden balls of the same size, one of a hard and heavy, and the other of a soft and light wood.

Either of these balls will float on the surface of a body of water and it will require some force to sink them; but, take them up and throw the heavy one, for example, with some velocity upon the water, and it will sink to a considerable depth before the resistance of the water will overcome its momentum or actual energy. Now take the light one and throw it with the same velocity, and it is doubtful if it will sink more than several inches. This goes to show that the weight has a great deal to do with the power of the mixture, in the working of the injector.

Another important point that should not be overlooked, and that is the temperature of the feed water.

So long as it is desirable to have the operation of the injector as perfect as possible, the temperature of the feed-water should not exceed certain limits, as it is necessary that the steam should be completely condensed.

In order that this may be as perfect as possible, and the operation of the injector the same, the feed-water must be cold enough to absorb the proper number of heat units that the steam contains, and be at a less temperature than 212 degrees Fahr.

It may be well to state here that the operation of the injectors of the ordinary form ceases, that is to say they will not do the work after the mixture reaches or exceeds 200 degrees Fahr.

The greatest temperature of feed-water, will, generally speaking, depend upon the pressure of steam. When the pressure of steam is high, the temperature of the feed-water must be lower than when the pressure is low. The greatest temperature of feed-water, in either case, can best be determined by experiment.

By carefully considering the foregoing, it is obvious that the amount of water that the injector throws must increase, in proportion to the amount of steam used, when the temperature of the feed water is raised.

It is obvious that it requires a greater amount of water to condense the steam, and be at a lower temperature than, say, 195 degrees Fahr., than it would if the temperature of the feed-water was lower.

From what we have already stated it will be seen, that when the amount of water is large in proportion to the amount of steam, that the velocity of the mixture also diminishes. This also applies to the above, when the temperature of the feed water is raised.

With a certain pressure of steam and temperature of feed-water, the power of the mixture may be just sufficient to overcome the boiler pressure; whereas, if the temperature of the feed-water is still increased, it would require a proportional amount of water to condense the steam; this would result in a proportional reduction of velocity, probably sufficient to render the power of the mixture valueless.

When the injector, shown in Fig. 1, is set so as to lift the feed-water it is started by placing the lever M in a vertical position, and opening a small jet valve which allows the steam to pass through a small pipe attached at P, which is connected to the small pipe S, through which the steam passes also; and in so doing, draws all the air out of the injector and water-supply pipe attached at J, thereby creating a vacuum, which results in the pressure of the atmosphere raising the water in the pipe, at J; and through the combining tube, thence out at *t* as indicated by the arrows and immediately appears at the end of the nozzle R.

As soon as the water appears at the overflow nozzle R. The main steam valve is gradually opened until it catches the water, when it is opened wide, and the small jet valve is closed.

Should no water appear at the overflow it shows that the injector is working all right.

Now, should the pressure of steam increase until the temperature of the mixture is high enough to cause the formation of steam, and a discharge of the same at the overflow, we must increase the water supply until this discharge ceases; after the discharge ceases it may be preferable to still increase the supply of water until there will be a discharge of water at the overflow; then gradually reduce the supply of water, for this reason, that in the former case you may have admitted just sufficient water to keep the temperature of the mixture below, say 195°, but you may have not given it all the water that the stream would safely carry into the boiler.

To describe the method of working all the injectors in use would require too much space; this is, however, generally described in the circulars of the manufacturers, who are as follows:

Wm. Sellers & Co.,	Philadelphia.
Rue Manuf'g Co.,	"
Schutte & Goehring,	"
E. Tracy,	"
Penn. Brass Works,	"
J. D. Lynd,	"
Nathan & Dreyfus,	New York.
National Tube Works Co.,	Boston.
Hancock Inspirator Co.,	"

Matt A. Beck.

Waterloo, Iowa, July 15.

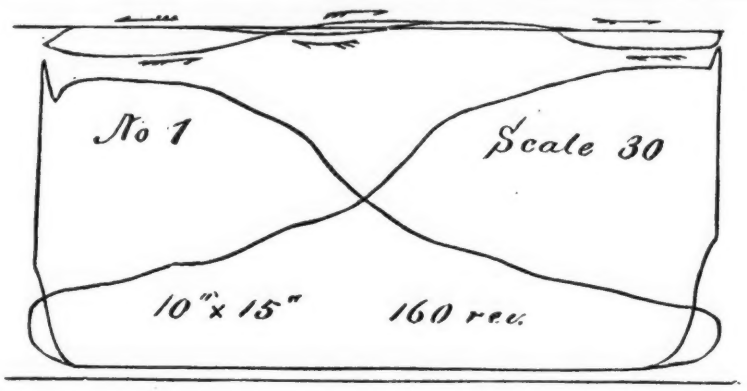
Mr. Editor:—

In "Question and Answer" No. 5, in your issue of July 26th, J. H. D. suggests that the initial and boiler pressure could be arrived at by taking diagrams from steam pipe. I enclose some diagrams taken some time ago, which shows the friction in pipes.

The first pair are from an automatic cut-off engine, cylinder 10 in. diameter, 15 in. stroke, running at 160 revolutions; scale, 30 pounds to the inch. Both diagrams taken at same time, with two Richards indicators. At this speed a Thompson indicator would have shown a smoother diagram.

The engine was fed by a 2½ inch pipe, about 60 feet long. Pressure in boiler 57 lbs.

I also send 3 diagrams taken from an engine 20 in. diameter, 48 in. stroke, running at 57 revolutions; supplied with steam by a 6 inch pipe, about 100 feet long, with 4 elbows. A 5 inch globe-valve shuts off the steam, and a short piece of 5 inch pipe runs

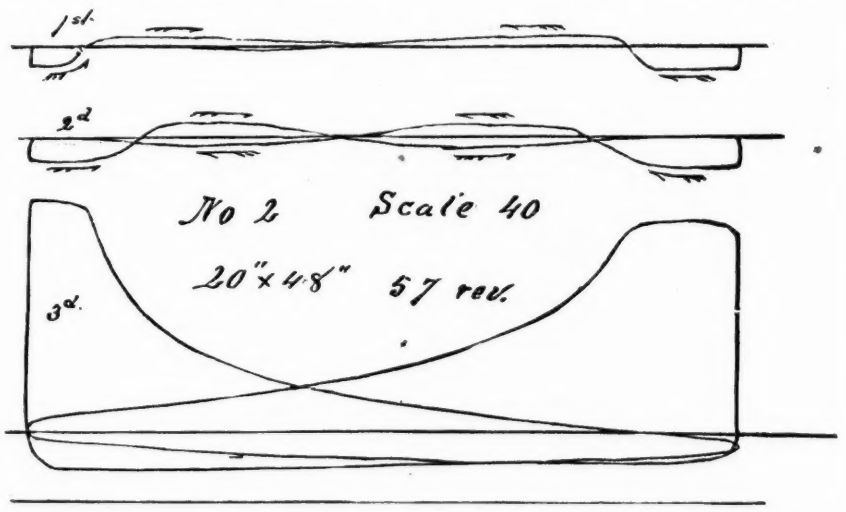


to cylinder. Two of the elbows and a part of the pipe was necessary, in consequence of the engine taking steam under cylinder. The friction of the globe-valve could also have been avoided if the engine had taken steam at side of cylinder, so that an angle-valve could have been used. The first of this set was taken from the pipe just before reaching the globe-valve. The second from the pipe just past the valve. The third is from the cylinder. The boiler pressure at the time the latter was taken was 63 lbs. The other two did not vary 5 lbs. from 63.

The load on engine changed in each, and the valves had not been squared, consequently one end does not cut off as short as the other, and the friction of the steam is greater at that end. The scale is 40 lbs. to the inch.

The two boiler lines shown are supposed to be the same.

It will be noticed in the first, that after the steam was cut off, it reset but very little



above boiler pressure; but in the second, the globe valve so obstructs the passage, that the pressure rebounds to above the true pressure, then falls below it, and finally reaches the true pressure just before taking steam again.

The object of taking these diagrams was to find where the loss between boiler pressure and the initial pressure in cylinder occurred.

After deducting the loss occurring from friction in pipes, and correcting the error in steam gauge, there was still a loss of several pounds to be charged to the friction through valves and ports.

The engine had poppet valves, and the steam had a crooked, cramped passage from pipe to cylinder. When opening widest, the steam had only 20 square inches area to pass through, and, under light load, only a small part of it was open. The cams are so made as to lift the valves just fast enough to keep pace with the increased piston speed, so that, when taking steam ¼ or ⅛ stroke, the line of initial pressure was nearly parallel with the atmospheric line, and the point of cut-off well defined, making a fine looking diagram. In fact, this style of engine was chosen in preference to that of another make, because it made a handsome diagram.

A siphon condenser was attached to the engine, but the diagrams were taken when first started up, and before the leaks were stopped, consequently there were only 18 inches vacuum. The exhaust valve is flat, each end something like the letter H, having a total area of 24 inches, so small that the loss in friction, though not so many pounds as in the induction valves—yet, as it checks during the whole length of stroke, is of nearly as much importance.

If this engine had been sold under the "iron-clad" guarantee, which Mr. Church suggests in one of his articles in a late issue of your paper, I think it would never have been accepted. Yours truly,

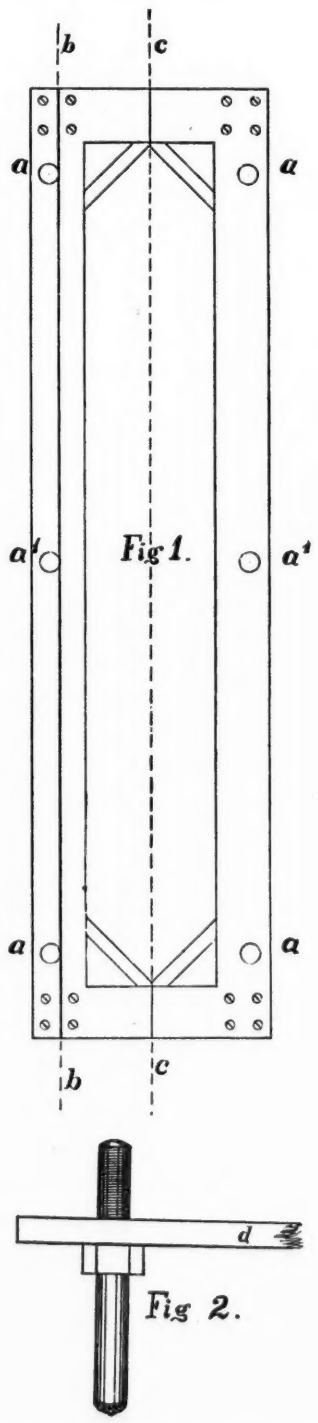
E. H. Robbins.

Setting Up Steam Engines.

Ed. American Machinist:

In setting up stationary engines, the first requisite is a template of the anchor bolt holes. This template is made of one-inch stuff, about six inches wide, and is merely a frame large enough to take in the holes in bottom flange of bed plate, as shown in Fig. 1.

The engine may be tilted up a few inches on one side and supported by short braces from the top flange. This will allow of the template being slipped under the bed plate and the flange holes marked on it through the flange holes. While in this position, if the side or edge of the bottom flange is planed true with the center line of engine, a line b. b., Fig. 1, may be scribed on the template true with this edge, to square the anchor bolts by an existing line of shafting in the building, as the case may be. If the top flange of bed plate is planed and the bottom one not, the line b. b. may be squared down from top flange. If neither the top nor the bottom flange is planed on the edge, a line may be put up through the cylinder centrally, extending the entire length of bed plate, which should be level or nearly so, and a line dropped from such end of this center line across the ends of bed plate and the bottom flange, marked fair with the line where it crosses it. This transfers the center line of engine to bottom flange, which in turn can be transferred to the template. The marks on lower flange had better be made while the engine is in the shop on the "floor" being put up. The lines so transferred are shown in Fig. 1 at c. c. The holding down or anchor bolts, which should have large heads, may then be slipped through the washers or anchor plate. A heavy anchor plate of cast iron, long enough to take in two opposite bolts, as a^1 a^1, is better than single washers. The bolts so prepared may then be placed upright in the foundation hole, the template resting on the nuts which should be run down a short distance, as shown in Fig. 2, d. being the template. The template and bolts should then be squared by the lines b. b. or c. c. to the shafting, if up, or the building, and braced in this position by several light braces tacked to it and surrounding objects. The foundation can then be laid on the anchor plates enclosing the bolts till the required height is reached. The top should be composed of large cut stones and carefully leveled. The engine, after the foundation has "set" sufficiently, may be placed on it, the bolts bringing it in line. It should be carefully leveled by iron wedges. A "runner," or small embankment of clay, should then be built as high as the top of the lower flange, both inside of bed plate and out, and extending entirely around it about a quarter of an inch from it. This "runner" may be bent out at several places into the form of a capital letter U, open side to the flange to facilitate the pouring of the melted sulphur or lead, which should be run up considerably higher than the bottom of the flanges, so that the hydrostatic pressure may keep it solid between the flange and stone. Cement, either Portland or Louisville, may be used in place of the lead or sulphur by "pointing" the crevice between bed plate and stone on the outside only with a thick mortar of the cement, and pouring a thinner mixture of the same on the inside. This may be worked beneath the flange with a trowel. After it is set the anchor nuts may be tightened, and the surplus sulphur, lead, or cement chipped off flush with the bed plate.



The writer has seen several engines set without the template, by building up the foundation solid without the bolts. The engine should then be leveled on the foundation and squared. Holes may then be drilled through the flange holes into the foundation, about 12 or 14 inches wider at the bottom than top. The bolts, which should be slightly tapered, being smaller at the top, may then be placed in the holes and sulphur or lead used as in the first plan. An 80 H. P. engine set by the latter plan six years ago is as solid to-day as can be wished. Sulphur will generally give the best results. When the latter plan is adopted, the foundation throughout should be laid up in cement. In setting up an engine it should be remembered that a foundation too heavy (if such a thing is possible) is preferable to one too light. The part below the earth should be laid of stone well below the frost line. The part above may be of brick topped with one or two cut stones. The pillow block foundation may be built the same as the engine foundation, and, being lighter, anchor bolts clear to the bottom better be used.

Yours, V. Hook.

Extracts from Chordal's Letters.

Mr. Editor:

* * * * How often, as we are engaged in our daily work, we find things wrong and make up our minds to make this thing or that thing right the first idle day, or when times get dull. And how often do we correct things when an idle day does come? Not once! I never was one to believe in the moral utility of rules or texts in a machine shop, but I believe a shop would not be a bad place to hang up a worsted motto bearing the golden words, "Now is the accepted time."

The owner or manager of a shop daily finds some detail out of gear, some big thing or some little thing. He thinks it ought to be fixed, but not now—some other time; and, as a consequence, it never does get fixed unless it happens to be one of those things which comes to a stoppage some day and has to be fixed. Then, of course, it is in a hurry and gets cobbled instead of being fixed sure enough. Every man around a shop, ordinate and subordinate, experiences the same thing. Johnny, a two years' boy at a lathe, thinks it about time to tear the apron of his lathe to pieces and oil it up; but not now, wait till his job is done, then he will do it before he gets another job. Not much, Johnny. You will never fix that apron till it sticks and can't be worked, and then you will have to do it just when you don't want to, and when your judgment tells you the time can least be spared.

The foreman thinks the drill sockets are getting in bad shape. They ought to be overhauled, but not now. When? When work becomes extra rushed and these same sockets get on a strike all at once; then is the time you will do it, and then is the time you will be too much rushed to half do it.

The superintendent thinks he will put a new foreman in the foundry, for he has found that a slight rush of work throws his present man off his balance and reduces his capacity just when it should be enhanced. He is a nice man and a good foreman within his small and inelastic field, but we are liable to emergencies, and this man must go. Not now, of course, but——when? When the emergency comes, and the foundry is driven, and the old man wo'nt do, *then* the new man *must* come and enter upon new duties under the most unfavorable circumstances.

The stockholders say, "We must absorb the Toggle Works; they want to sell and we must soon find something to take the place of Harding's orders which are to leave us. But not now. Oh, no! We must wait till Harding has been gone a month and things look thin, and the Toggle Works, with eyes as good as ours, know how essential it is that we buy their business at their price.

It has been my fortune to be a hand on the opening day in several little shops, and right here my mind goes back to Ingraham's, and I must tell a story. Ingraham started a little shop way off out of the world. The inhabitants had never seen melted iron, or much of anything else, and he had things arranged to make his first heat an occasion of importance in the town. Grand announcement—flourish of trumpets—circulars of invitation to the best folks in town—lemonade—brass band—ice cream—raised seats for the ladies, and all such. The day came, so did the people. The fire had been lighted and the cupola charged. Ingraham superintended, and explained, and smiled acknowledgements of many congratulations.

But the iron would'nt come down, and never did come down till the bottom was knocked out. Ingraham was a bachelor and could be confused sometimes, which may account for the iron being under the fuel.

But aside from music and ice cream, I remember that shops within my experience were always started with the intention of fixing things better after the thing got moving, and I never saw anything fixed till a radical change became imperative. A lathe is speeded too fast. The proper pulley had not come and the main shaft was ready to go up, so a larger pulley was put on to drive the lathe. Was the right pulley put on when it did come? Not much. It went into stock, and in two years some lathesman insisted on having that pulley changed if he was to run the lathe and do lots of work. Thick stuff gives out, and two-and-a-half inch stuff used for a couple of vise benches—temporarily, of course, but they danced tools and work off for years till Dennis himself happened to use one of the vises and found out what the boys had to put up with. There must be a foundation under that planer, of course; anybody would know that, but we can start it up, you know, and fix the foundations when the masons are here again. Yes, I know. Masons come and go, but that planer goes on forever.

The only time to do things is when the consciousness that they are necessary arrives. When we have nothing else to do we don't want to do things. That's human nature set to music in the Arkansas Traveler and brought to mind each day in the shop. An excellent rule is, to do things right and stop when they are done right, and the rule is justified by the simple fact that it is most always cheaper.

I have set up many engines, cutting and fitting every pipe, and I at one time was the worst slouch that ever did such work. My ambition seemed to be to get lines of pipe in position and get things started. If I had doubts of a pipe joint I would say to myself, "I guess that will do; if it won't I will fix it." Soon every joint was made on the same plan. Of course, the doubt was only settled when steam was let on, and then the thing got "started" under a cloud of steam which would even prevent inspection. Then the whole thing had to be gone over. Common sense overtook me one day, and I changed my tactics and settled all doubts about pipe joints when I made the joints. I saved time, money and good nature by the conversion.

If repairs are to be made, I think it cheaper to make them at once, even in a rush of business, than to await an idle day which we hope will never come. If a shop starts with loose joints, premature or temporary arrangements, or lack of system, it will run so till a new shop is built.

Few men have the foresight or money to provide for everything, but the omissions referred to are seldom dictated by economy or ignorance.

It is a notorious fact that a millwright will stay on one job as long as there are any inducements—social, political, financial, geographical, religious or otherwise—to do so. He only quits to go on a better job. This is a long and expensive way to reach good results, but we seldom find in a mill any temporary or shiftless executions of the original plan.

* * * * Tell a hap-hazzard manager of system and organization and you make him sick. He thinks you lay out more work for him than is involved in the regular business which your system is simply an adjunct of. The fact is you tell him too many novel things at once, and he thinks all hands must quit real work and devote themselves to keeping your red tape chalk line straight.

Not so. System is not work, but is simply a law of action for reducing work. It does not require special executors, but permits few to accomplish much. It loads no man with labor, but lightens the labor of each by rigidly defining it. Hard work begins when system relaxes. System never, under any circumstances, interferes with variations in human action, but includes them. Elasticity is not a quality of system. Comprehensiveness is. System is the result of two rigid laws: a place for everything and everything in its place, and specific lines of duty for every man. The laws being written, understood and executed, lightens the responsibility of every man. In many shops half the things are everybody's business and never done, the other are nobody's business and half done.

Law without execution is no law, and in the shop we find empty law adds to illegal work.

Many shops let their system drop during the hard times, and now that things are picking up they wonder why their capacity is so limited. I know one excellent shop which had a tip-top pattern system, in which there was a fixed responsibility for every thing, and no dependence placed on the memory of any man. A stranger could enter the place and receive five minutes' instruction which would enable him to find any piece of pattern of any of three hundred machines. Those instructions would be: "Each machine has a short symbol as shown on its drawings, and every piece has a number also shown. Each pattern, or piece, or scrap is stamped with the symbol and number. The pattern store room contains all patterns not in use or being repaired, and shelves are symbolized to correspond with their symbols. The pattern store room has a sign on the door." With such instructions a stranger could be given any drawing and asked for a piece shown thereon. He could bring it in ten minutes, even if totally unacquainted with the premises, providing it was at home. If he did'nt find the pattern, he would find a slate telling him to call at foundry, or pattern shop, or at malleable foundry a hundred miles away. A simple arrangement this, and it did not cost ten cents a year, and saved many dollars, as simple and satisfactory plans pervaded foundry, machine shop, blacksmith shop, wood shop, boiler shop, store room, ware room and office, and more work was done by less men with less hard work than one often sees.

But the man who organized this thing was wanted elsewhere and went. He has been gone five years and has organized another concern which has, within the last few weeks, had to buy a railroad to use up its earnings.

A few days ago I visited the first concern, and found that the organizer had carried away the statute books, and the system had gone to the bow-wows. There were patterns in the pattern room in place and out of place, with marks and without marks. There were patterns stored in the pattern shop, in the drawing room, in the drawing vault, in the store room, and I don't know but elsewhere, and there were castings stored in the foundry, and casting room, and machine shop, and wareroom. There is no one man about the place who could find a piece of pattern or casting without a scientific search over the whole place, or an inquiry as to its whereabouts. The short cut, of course, would be to ask some one supposed to know, who would tell you or send you to some one else who might know where the particular piece was. If some subordinate would get sick the shop would kill him with business messages.

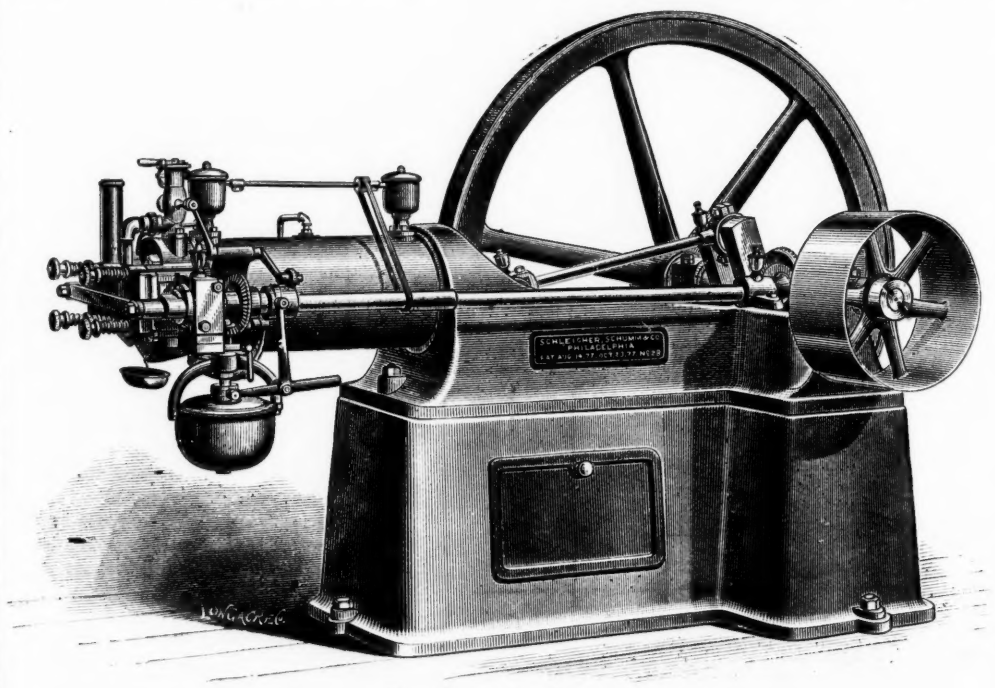
* * * * Few men can organize, and they do wrong if they fail to leave the law behind them. In the above case the owners could say to a new executive officer: "Take this and maintain it." As it was, "this" had gone with its maker. I never heard of anything great being accomplished in productive, legal, military, naval or social art without organization, and I never knew organization to fail to result in economy. Of the detail of the law, and of examples of organization in shops in this country, I may write you hereafter.

* * * * Printed rules, stuck up in a shop, are objectionable and hurtful, because instead of defining a man's duties they dictate his conduct.

A monarchy exists on the ability of the educated few to dictate and enforce good conduct among the ignorant masses. Republics look to the self-dictated good conduct of the masses. Specific rules imply license beyond, and, as a consequence, monarchies don't dare to run a bell-rope through a railway train, or leave rules of conduct out of the shop.

If you want to elevate the morals of your shop and of republican citizens, cut the conduct clauses from your duty regulations, and kick every man out who has not sense enough to "conduct" himself. * * * *

Yours respectfully, Chordal.



The Otto Gas Engine.

The Otto Silent Gas Engine.

We illustrate upon this page the Otto Silent Gas Engine, built by Schleicher, Schumm & Co., 3045 Chestnut Street, Philadelphia, the regular sizes manufactured being 2, 4, and 7 horse-power. It can be lighted by a single match.

As will be seen from the cut, the engine consists mainly of a jacketed cylinder, with piston, side valve, and governor, having a cut-off mechanism to regulate the supply of gas, according to the varying load on the engine. The pressure utilized for the production of the power is generated in the cylinder, and is at once available to propel the piston. This pressure is due to the combustion of a peculiar mixture of common coal gas and air, which is ignited by a small flame, carried from a burning gas jet outside into the cylinder by the motion of the slide. The principle of combustion in this gas engine is claimed to be entirely new; a small part only of the charge is combustible, which, on ignition, serves to expand the remainder, thus avoiding shock, and effecting—when compared with some motors of its class—a marked economy.

It is also claimed that the "Otto" Gas Engine possesses the least number of working parts, and the greatest simplicity of mechanism ever yet attained, running with a degree of smoothness and regularity of speed, hitherto unknown in gas engines.

Concerning the comparison with steam in the matter of running expense, and the amount of gas required, the claim is made for the gas engine by its promoters, that, as it requires no boiler, it avoids all the expensive attendance or loss of time, which the watching of water level, feed pumps, and steam-pressure gauge demand in a steam engine. The gas flows in freely, and there is no handling of fuel of any kind, and no ashes. Thereby, hardly any item of cost for attendance is to be considered, almost the total expense of running being for the gas alone. The quantity required has, in the "Otto" Engine, been reduced to about one-fourth of what older constructions required, and will average for the different sizes of engines, twenty-one and one-half cubic feet of gas per ind. H. P. per hour. While running, however, the cut-off being in constant operation, the "gas consumption is limited in proportion to the load on the engine." Thereby, in practice, in many cases only $\frac{1}{8}$ or $\frac{1}{4}$ of the above rate of consumption is reached. The engine costs nothing while standing, and is started and stopped without waste of fuel and time, while another important pecuniary saving is often to be derived from low rates of insurance.

While it does not lie within the compass of this article to take sides upon the question of the comparative advantages of one kind of small motor over another, whether depending for its power upon either steam, air, or gas (our object being simply to present the claims of all the good things and let the best win), there would seem to be no doubt that the gas engine can be favorably recommended for all kinds of light work, as well as for many purposes where no other power is available. Where small power is wanted it will, in most cases, be required to run with a varying load, or at intervals; thus, with this engine, reducing the trouble of keeping the power up to a working standard to the minimum degree.

This feature, together with their entire cleanliness, no space for fuel being demanded, render gas engines highly suitable for use in printing offices, stores, jewelers' work-shops, etc. Their instant and constant readiness for work, and perfect safety, which leaves insurances unaffected, also make them very economical and convenient for use as hoisting engines in stores and warehouses. They may also be profitably adopted in schools and academies; for pumping or ventilating in hospitals; for public buildings, hotels, etc.; for blowing organs, running electric machines for illuminating purposes, or electroplaters; running oil and spice mills, coffee roasters, meat choppers, sewing machines and boat machinery, exhausters and ammonia pumps in gas works, etc., etc.

The ordinary method of determining the nominal H. P. in small engines being unavailable in the case of the gas engine, owing to the difference in their working principle, the gas engine makers have adopted the rating of power by indicated H. P. figured from indicator cards taken from engines.

As to durability, the wearing qualities of the gas engine, which is composed of nearly the same essential working parts as the small steam engine, would appear to be beyond question, there being little chance for breakage, while all parts are easy of access for adjustment or ordinary repairs, and are made exactly to gauge. A book of instruction is sent with each engine.

The Otto gas engine has met with very great success in England and on the continent, as evidenced by the long lists of foreign users; and, though the extravagant rates demanded by the gas companies in many American cities have operated as a hindrance, there would seem to be no good reason why they should not reach an extended sale in this country.

Lexington, Ky., is contemplating the erection of water works.

New System of Ventilation.

We describe herewith a new ventilating process, of purifying and cooling the air in warm weather, and purifying and warming the air in cold weather, lately introduced in a portion of the Kings County Court House, Brooklyn, N. Y.

As the question of how to obtain good ventilation has been before the public for some time, a brief description of this new method will be interesting to many, especially those in charge of public schools and other buildings.

First, the air is drawn from the outside of the building, through an underground air-duct, by a large fan blower seven feet in diameter, that runs 170 revolutions per minute, and is driven by a small steam engine that is connected direct to the fan shaft. The same fan blower then forces the air to and through a tank, 9 feet in diameter, that stands upright, and is filled with charcoal, in pieces about the size of furnace coal, over which a constant supply of pure cold water is scattered by a revolving sprinkler working inside of the tank. This water is obtained from a tube, well constructed in the earth, to a depth of 60 feet, and is of a uniform temperature, about 54° Fahrenheit, the year round. From the top of this tank are a number of large galvanized iron pipes, running to the heating and ventilating flues in the wall, through which the air is still forced, and then passes into the different rooms through the register and other openings. By this process the air has not only been purified, and made free from all foreign substances, by the two best purifiers known (charcoal and water), but is also brought nearly to the same temperature as the water used. By this, making the purifier a heater in winter, when the atmosphere is lower, and cooler in summer, when the atmosphere is higher. This, the inventor claims, is the most valuable part of the invention, as it brings the air at all seasons to a temperature that contains the proper amount of moisture that is most beneficial; for in summer it absorbs, and in winter it adds the necessary amount of moisture for the purpose named. In winter, after the air passes through the purifying tank, the temperature of same is increased by the steam heater through which it is brought in contact in the usual manner, but as the water has already raised the temperature of the air, say from 20° outside to 50°, the steam heater has only to have sufficient heat to increase it to about 80 degrees.

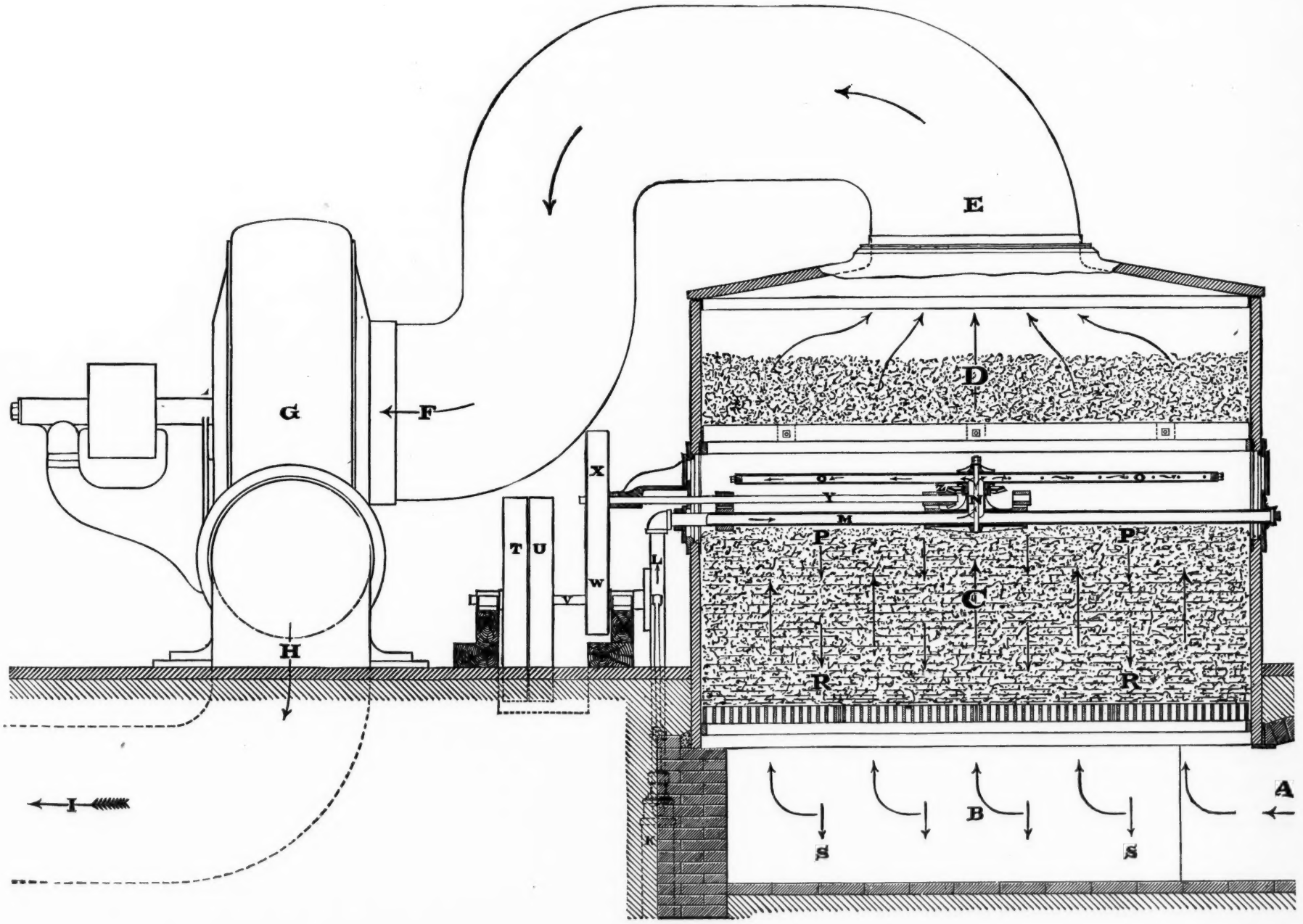
Thus a large percentage of fuel is saved over the usual method of heating, as well as obtaining good ventilation with pure air. The inventor claims that sufficient air is discharged into the different rooms to at least change the same every 10 minutes, and by this method of induction and eduction a thorough circulation takes place. He also states, that on several different occasions he has placed thermometers in different parts of each of the rooms, and finds that the temperature of the rooms only increases from two to three degrees from an empty to a well-filled room, which clearly shows the supply of air is sufficient to counteract the differences and obtain thorough circulation through the rooms. Another good feature claimed for this method is the fact that, if the air in passing through the air duct should come in contact with sewer or other foul gases, or supply is bad, the purifier separates them and the gases are carried off with the water that is constantly passing through the charcoal into the sewer. This water, after doing its work in the purifier, is again used to condense the exhaust steam of the engine. Thus avoiding the annoyance of escaping steam on the roof. The engine also works the pump for raising the water from the well, and distributing through sprinklers on the charcoal. The steam power requisite is furnished by a small steam boiler, eight-horse power, working under a low pressure, which consumes only a small quantity of coal per day, and is capable of heating the rooms ventilated in ordinary cold weather. The Court officers in the rooms ventilated freely state, that a remarkable improvement has been made, and their faith in the method increases with their experience, and during the heated term lately passed, while court and other offices in the building adjourned on account of the oppressive heat, the court offices then ventilated were crowded through the entire day, and business was done the same as though the outside temperature was 75 degrees instead of 98, as it was. All the windows being closed, and the court room crowded, made a remarkable contrast in favor of their method. It is stated that a number of scientific experts, including some well-known physicians, have examined and strongly endorse this plan, as not only being comfortable, but beneficial to health; and that there is no doubt that this system applied to our manufacturing establishments would greatly improve the workmen, enabling them to do more work than usual during the summer season. It has now been in operation since April 1st, and to those interested in ventilating the apparatus is worthy of a close examination.

Another important feature of this plan is that the windows are kept closed even in the hottest as well as the coldest weather, thus avoiding drafts, dust, and noise, making it very desirable for hospitals, schools, public buildings and halls.

The annexed cut is a view of the apparatus used in this new mode. The purifying tank being in section shows the interior. The air is introduced through an air duct at A, passes into the space B, under the tank; through C, D, E, F, G, H, and discharged through the pipe I.

C and D are layers of broken charcoal; E, F is the connecting pipe between purifier and fan-blower G, by which the air is forced through H to I, from which point it is distributed to the various rooms to be ventilated. K is a pump to obtain water through a tube well from a depth sufficient to insure its being uniform in temperature the year round. The water is forced through the pipes L, M, N, into the sprinkler O, O, which is constantly revolving, and is perforated with small holes in its entire length, causing a shower which percolates down through the charcoal in the direction shown by the arrows P, R, S, whence it is conducted to the sewer.

The pulleys T, U, and W, X, drive the pump shaft V, and sprinkler shaft Y, which last is geared to the sprinkler at Z, to revolve it. The lower bed of charcoal (C), being constantly wet, is necessarily kept at, or near the temperature of the water (say 54° Fahr.), and presents an aggregate of tens of thousands of square feet of surface through which the air is drawn. If, at its induction, the air is higher in temperature than the water, the water absorbs the surplus. If it is lower, the water supplies the deficiency.



In practice the air is discharged from the purifier at a temperature ranging from 50° to 60° Fahr., while being inducted at a temperature ranging from 0° to 150° Fahr. The purifying properties of pure water and charcoal, either separate or together, are too well known to need emphasizing here, but two important results obtained, besides those already named, are, that the air by contact with the water is brought to the temperature at which it naturally retains the most healthful quantity of moisture; and in winter the heating appliances have never to overcome a lower degree of temperature than say 50°, no matter what it is out doors.

The upper bed of charcoal D, is merely supplementary, and is designed to arrest any particles of water which the force of the air in its passage through the lower bed C may carry above the sprinkler. This system of ventilation in connection with steam heating is being introduced by Joseph Edwards & Co., Ventilating and Heating Engineers, 414 Water St., New York.

AMERICAN MACHINIST

PUBLISHED WEEKLY
BY
American Machinist Publishing Co.
HORACE B. MILLER, Prest.
LYCURGUS B. MOORE, Treas.
JACKSON BAILEY, Vice-Prest.
DAVIS STRONG, Sec'y.
96 Fulton Street, New York.

JACKSON BAILEY, Editor. HORACE B. MILLER, Business Manager.

LEWIS F. LYNE, Mechanical Engineer.

Edition, 7,500 Copies.

The American News Company.
Publishers' Agents, New York.

The International News Company,
(Formerly the Willmer & Rogers News Co.)
11 BOUVERIE STREET, (Fleet St.) LONDON, ENG.
Will receive subscriptions for the AMERICAN MACHINIST at 17 shillings per annum, postage prepaid.

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SUBSCRIPTION.

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$4.10 to Foreign Countries, postage prepaid.

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Inside pages, 20c. per line, (12 lines one inch.)

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NEW YORK, AUGUST 16, 1879.

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We desire to extend a special invitation to practical boiler makers and blacksmiths, requesting them to give our readers the benefit of any new or useful methods that they may have thought or worked out in these departments, accompanied by pencil drawings of the same.

Special.

We wish to make the following facts fully understood by our readers:

1st. That nobody has ever paid the publishers of the AMERICAN MACHINIST one cent for anything inserted in its reading columns, either for illustrated descriptions of machinery and tools, contributed articles, editorials, manufacturing notes, book reviews or reviews of shop supplies.

2d. That we never will publish any notice for pay, either direct or indirect, except in our advertising columns.

3d. That no party interested in making or selling machinery, engines and boilers, or in their manipulation has or ever has had any pecuniary interest in the AMERICAN MACHINIST.

Correct Tests of Pumping Engines.

During the present summer some interesting and valuable tests of water works pumping engines have been conducted by Mr. Richard H. Buel, of this city, representing Park Benjamin's Scientific Expert Office, for the purpose of obtaining reliable data for publication in Appleton's Cyclopœdia of Applied Mechanics. As these tests were conducted upon the same general plan, as near alike as it was possible to do under all the circumstances and under entirely different auspices from "contract trials," by an acknowledged competent expert, and with the greatest care as to conditions and details, they may be regarded as furnishing correct results for comparison. The engines tested were all of the compound type, and were taken in order as follows: Holly Pumping Engine, Buffalo, N. Y.; Corliss Pumping Engine, Pawtucket, R. I.; Leavitt Pumping Engine, Lawrence, Mass. Before and after each of these tests all gauges used were carefully compared with a mercury column, and the accuracy of scales used to weigh feed water and coal carefully checked. Before each trial, the fires, which had been left banked since stopping the day before, were drawn, the grates cleaned and new fires built, all the coal and wood used for kindling, as well as that placed upon the grates while running, being carefully weighed and charged to the engine in making the final computation of duty. Wood was reckoned at forty per cent. of its weight in coal. The exact steam pressure was noted at the time fires were started, and when, after the last firing, the pressure fell to this point, the trial was stopped and fires drawn. The coal not burned was picked out at the close and weighed. In all the indicator experiments the scales of the springs were determined by experiment, the scales of those used on the water cylinder being tested under water pressure, and those used on the steam cylinders being tested under steam pressure.

The Holly engine has four steam cylinders, each 25 in. in diameter, the length of stroke being 33 in. There are four pump cylinders, having a diameter of 15½ in. and 33 in. length of stroke. There are six suction and six discharge valves at each end. The area of opening through each set of valves is 149.96 square inches. There are two boilers, internally fired flue and return tubular. The diameter of shell is six feet; length of boiler, 13.88 feet; internal diameter of one flue, 16.75 in., and two others, 11½ in. each; length of flues, 4.65 feet. The number of return tubes in each boiler is 86; outside diameter, 3 in.; length, 11.95 feet. The total grate surface is 42.68 square feet; total heating surface, 1967 square feet, and ratio of heating to grate surface, 46.1.

The trial of the Holly Engine lasted eighteen and seven one-hundredth hours, the speed averaging 21⅓ revolutions per minute. The average pressure on all steam pistons was 21.08 lbs. to a square inch. The water pressure reduced to the equivalent pressure on the steam pistons was 17.86 lbs. per square inch, so the efficiency of pumps, as measured by pressure in the main, was $\frac{17.86}{21.08} = 0.847$. The trial showed that the number of pounds of water evaporated per pound of coal from and at 212° was 13.63. The percentage of ashes was 6.39. The coal per indicated h. p. per hour was 1.94, and feed water, per indicated h. p. per hour, 21.46 lbs. The coal per effective h. p. per hour was 2.31 lbs., and feed water per effective h. p. per hour 25.51 lbs. The duty of the engine for each 100 pounds of coal consumed was 86,176,315 foot pounds.

The Pawtucket Corliss Pumping Engine was described in the AMERICAN MACHINIST, October, 1878, with which we published a large illustrated supplement giving a view of the ground plan and another of the side elevation of the engine.

The Corliss pumping engine has two steam cylinders and two pumps in line with the cylinders, the pump piston rods being continuations of the steam piston rods. The pumps consist of plungers working through packed rings. The pump valves are arranged around the pump barrels and consist of thin discs of phosphor bronze kept to their seats by light spiral springs of a peculiar form which also serve as guides. The diameter of the high pressure cylinder is 15″ and that of the low pressure cylinder 30″. The pump plungers are 10.52″ diameter. The stroke of cylinders and pumps is 30″. The effective area of pump plunger is 82.012 square inches, and the displacement of both pumps per revolution 5.6953 cubic feet.

The boilers are the Corliss vertical five tube set in brick, a central space in each being free from tubes. The shell is ⅜ inch thick. The common flue connecting the boilers with the chimney contains two clusters of pipes, through the first of which the condensed steam drawn from the receiver is forced, and the feed water is pumped through the other on its way to the boiler. There are three boilers, each four feet diameter and 14 feet high. There are 48 tubes in each boiler, each 3 inches outside diameter. Total grate surface 58 905 square feet; total water heating surface 1231.5 square feet, and superheating surface 508.8 square feet; ratio of water-heating surface to grate surface 29.5.

The trial lasted 14 hours and 23 minutes.

The average revolutions per minute was 50.12, and the pressure against which the pumps delivered water 112.4 pounds. The efficiency of the pumps, as indicated by the water pressure, was found to be 0.92444 of the indicated power of the engine. The coal consumed, per indicated H. P. per hour, was 1.67 pounds; coal per effective H.P. per hour was 1.81 pounds.

The test of the Corliss pumping engine showed a duty of 109,679,487 foot pounds with each 100 pounds of coal.

The Leavitt pumping engine has one high pressure and one low pressure steam cylinder and one bucket and plunger pump. The high pressure cylinder is 18 in. diameter and the low pressure 38 in. The pump barrel is 26.125 in. diameter. Stroke of steam and pump pistons 8 feet. The number of receiving valves is 7 and the area of opening through valves 500.29 square inches. There was used one boiler of the locomotive type having 80 tubes, 3 in. diameter outside and ten feet long. The diameter of shell is 5.25 feet, grate surface 28.75 square feet, and heating surface 10.20 square feet.

The ratio of heating to grate surface is 35½.

The trial continued 15.1 hours. The effective water pressure on water piston, while taking indicator diagrams, was 76.7 lbs. per square inch. The indicated pressure on steam pistons, reduced to equivalent pressure on pump piston, was 83.69 lbs. per square inch. The efficiency of the pump was $\frac{76.7}{83.69} = 0.91643$. The number of pounds of water evaporated per pound of coal from and at 212° was 11.49. The percentage of ashes was 6.14. The coal burned per indicated H. P. per hour was 1.63 lbs.; the feed water evaporated per indicated H.P. per hour 16.48 lbs.; coal per effective H. P. per hour 1.78 lbs.; feed water per effective H. P. per hour 17.98 lbs. During the trial the engine made 12,337 revolutions, and 3,633 lbs. of coal were burned. The duty of the engine for each 100 lbs. of coal consumed was 111,548,925 foot pounds.

It is hardly necessary to remark that these results are all exceptionally good, though we can discover no reason why they cannot be equaled in practice by regular running if careful attention is given to every detail. The coal used in each case was of best quality and carefully screened. In making comparisons of results, it should be borne in mind that the Holly pumping system is essentially different from any other, inasmuch as it delivers the water directly into the mains under a regulated pressure, and would not, therefore, be expected to give as high a duty as by other methods of pumping.

A New Usurpation.

Every few days we hear of some new aggression upon the part of capital against somebody's rights, and this time the culprit, who, naturally enough, seeks to conceal his name, has a nefarious scheme on foot, in the shape of an attempt to rob the New York poor of one of their most cherished privileges. Everybody knows that the privilege of buying coal by the scuttle and pailful, and of paying at the rate of $10 a ton for it, is one never to be highly enough valued by the poorer denizens of this and every other large city, and yet here we have a bloated and anonymous capitalist offering coal *in any quantity at cost*, viz: $5,00 a ton, by means of a system of tickets calling for 5, 10 and 25 cents worth respectively.

To any one who has had any considerable experience of city life, this is really too revolting, since the kind and just liberality of the regular retail coal dealer has been proven by numberless examples, instances having even been known in which certain dealers have actually allowed wealthy and well-posted buyers 2,000 lbs. to the ton! And yet upon the very heels of all this, comes this atrocious and undeserved slur, ostensibly in the interests of a class who are notoriously averse to the idea of buying coal at a less price than $10 a ton.

If this state of things continues, we shall soon hear of capitalists, tired of throwing away money in the ordinary channels of pleasure, who are actually bent upon establishing *cooperative manufactures* upon the joint stock plan, and of allowing their workmen to buy the whole thing out afterwards by piecemeal installments at honest cost figures!

The only adequate remedy for this state of things is by arousing public sentiment to a realization of these nefarious aggressions upon the part of the moneyed classes, before others of them take it into their heads to do more and worse things of the same sort.

A Good Example.

Invention in these days has reached a point requiring every inventor, before he can afford to spend the time or money needed to develop any really good idea, to know what others before him have done in the same direction. And not only is this true of invention proper, but of every useful method or advanced principle in mechanical matters. To any one, therefore, who realizes this fact, and takes into account the further fact that a very large proportion of the new and useful improvements, which are daily appearing, are the work of mechanics, earning only ordinary shop wages, the value of a thoroughly equipped library, at all times available to all grades of workmen, becomes readily manifest.

The best, and indeed the only example of a complete Machinists' Library, collected and kept up by employers at their own expense, for the benefit of their employees, that has come to our notice, is that established some years since by the Brown & Sharpe Manufacturing Company, of Providence, R. I. This admirable collection of useful and practical books contains about 1,000 bound volumes, and, while largely devoted to the special mechanical subjects, which, more than any other, are likely to be of interest to mechanical readers, includes also a liberal sprinkling of biographical, historical and philosophical

works, calculated to inform the minds and direct the judgment of busy but eager students.

Whenever a new book comes out that is considered worthy of a place upon the shelves of this library, it is promptly purchased, and immediately begins to add its store to the intelligence of hundreds of earnest, thinking workers. And not only is this gain an intellectual one, but, during all the years during which this Company have quietly but persistently carried on this noble experiment, its projectors have felt themselves fully repaid in actual money by the increased efficiency of their men.

Instances are not wanting of libraries containing a greater or less proportion of mechanical books which are intended for the use of workmen, but we know of no other at once so complete, and so available for this purpose. The Astor Library, in New York, closes daily at 5 p.m., and is therefore useless to working mechanics, except such as are "on strike," and shrewd observers are of opinion that striking mechanics seldom read. The Cooper Institute Library, New York, contains many useful books upon mechanical subjects, but they are not allowed to be taken from the room, making this collection very inconvenient to general readers. Many of the public libraries in our American cities, contain a greater or less number of mechanical books, but these works usually constitute but a sprinkling of the total number provided for other classes of readers, notably the perusers of trashy fiction.

We commend the shrewd and noble example of the Brown & Sharpe Company, as one worthy to be followed by employers everywhere, feeling confident that their material gains, through such action, will keep full pace with the satisfaction that is always accorded to those who go out of their way to do a generous action.

Machine Shop Wages.

Armington & Sims, Lawrence, Mass., pay machinists from $1.75 to $3.00 per day, averaging about $2.00; blacksmiths, $2.25; apprentices, 80 cents per day for the first year, 90 cents second year, and $1.00 for the third year.

Hancock Inspirator Co., Boston, Mass., pay machinists from $1.50 to $3.50 per day.

Geo. W. Fifield, Lowell, Mass., pays machinists from $1.00 to $2.00 per day, averaging $1.50; helpers, 75 cents to $1.00.

S. H. Powers, Chillicothe, Mo., writes us: I send you list of wages of the different branches of mechanical business. However, there are no machine shops located at this point, but at Moberly, Mo., there are large R. R. shops of the St. Louis, Kansas City and Northern.

Machinists get from $2.25 to $2.75 per day; boiler makers, $2.50; engine runners, $3.75; moulders, $2.25 to $2,75; pattern makers, $2.50.

LITERARY NOTES.

THE RIGHTS AND WRONGS OF LABOR, by Frank H. Norton: published by the American News Company, 39 Chambers Street, New York. Sent by mail for 25 cents, post paid.

The author of this pithy little pamphlet, Mr. Frank H. Norton, is known to most cultivated New Yorkers, as being formerly assistant librarian at the Astor Library, and for many years as a capable writer and journalist. But in endeavoring to charge upon machinery the blame for most of the ills that the world's workers at present suffer, Mr. Norton has undertaken a pretty big contract. Nevertheless this little book compresses much valuable and suggestive information in little space, and is well worth perusing.

Chapter I embodies a very succinct sketch of the conditions of ancient labor, showing the history of those early times to be little more than a record of the struggles of the enslaved masses against their oppressive taskmasters, in each instance ending either in national ruin (as Phœnicia, Carthage, Greece, Rome), or in the forced recognition of the nobility of *hand-labor*, as came to pass in Northern Europe during the Middle Ages.

Chapter II deals with the handicrafts and labor-guilds, whose influence so largely dominated the nations of Europe during the centuries known as the Middle Ages, following the subject down to the 16th and 17th centuries, when, owing to the introduction of power and machinery, the craftsmen's guilds degenerated into commercial bodies under the control of capital on the one hand, and trades unions, devoted to the real, or fancied interests of the wage-working classes upon the other.

This chapter, while both interesting and instructive, leaves out of the account, however, what we believe the true statistics would show, viz.: that, if the fate of the great mass of workers has always been to endure some kind of dependence, machinery has rather changed its form than materially damaged its conditions. In other words, the craftsmen of the Middle Ages, self-employed on a few simple branches of handiwork, find their modern prototypes in the hundreds of thousands of eager employers who are to-day directing millions of paid workers in countless branches of industry. And who shall say that, but for the changes brought about by the introduction of machinery, the great mass of these toiling millions would not to-day be, for all practical purposes, the helpless and illiterate *villeins* or serfs of the soil that their ancestors before them were, during the days of hand-labor?

Meanwhile, if one class of machinery still weighs down their bodies, the steam-driven printing press affords, both to them and to their children, opportunities for mental improvement and craft-culture that the era of hand-labor never did and never could supply.

This chapter suggests one very instructive lesson, however, and that is the advantages of a return to the ancient system of *apprenticeship*, wherever practicable, and the consequent thorough knowledge of every part and detail of his trade by every workman.

Happy it is for the workers in the trades represented by the AMERICAN MACHINIST, that so many, unless they willfully give way to carelessness or inertness, are privileged to rise above the dead levels of mere machine-feeding!

Chapter III of the pamphlet before us, after a ramble among the Chinese, which may be pertinent a generation or two hence, but hardly seems so now, contents itself mainly with touching here and there upon the modern questions of "Trade-Unions and the relations of Human and Machine Labor," without analyzing either branch as thoroughly as could be wished, or suggesting an adequate remedy.

The author is faulty in at least one of his illustrations, or deductions in this chapter when he says:

"As to the necessity for the vast and unwieldy factory system, the claim is answered by the fact that India, by hand-labor alone, consumes more cotton than all the rest of the world put together, aided by machinery and both water and steam power."

Viewed from the standpoint of the wages-worker, which we take to be the chief point made by the author, it will hardly be seriously maintained by any one that hand-labor (as opposed to machinery), finds a favorable exemplar in the condition of the despot-ridden, poorly-paid, and half-starved denizens of the land of Tamerlane and Hyder Ali, either now or at any time in their past history.

The fact remains that the wage-earning classes will never permanently better their condition until, by education and increase of skill, they share some of the advantages now so largely monopolized by employers. For example—hardly one employer in ten operates wholly upon his own financial capital; others entrust to him the handling of their means, because he has shown himself *skilled* in his calling. Let workmen train themselves and become *really skilled* in their respective callings, and they will no longer have use for trade-unions, as at present conducted. At least, it is an open question, whether, if half the capital and credit that have been wasted upon costly strikes (re-enforced by that greater capital which sobriety and thrift can always command in due time) had been used to build up *co-operative manufactures*, benefiting capitalist and craftsmen alike, there might not be to-day a pleasanter state of things to record, than now obtains in too many branches of modern industry.

POCKET-BOOK OF MECHANICS AND ENGINEERING.--Containing a memorandum of facts and connection of *Practice* and *Theory*, by John W. Nystrom, C. E. Thirteenth edition, revised and greatly enlarged, with original matter. Published by J. B. Lippingcott & Co., Philadelphia, Penn. Bound in leather tucks, price $3.50.

The above work has won for itself a high position as a book of reference, having passed through twelve editions, and is now on the thirteenth. It contains 512 pages, closely printed, on fine paper. The author, who has been well-known for a number of years, as an expert in this particular branch—that of mechanics and engineering—starts out with the very practical suggestion that every engineer should make his own pocket-book, as he proceeds in his studies, or practice, and the most successful men that we have ever known have been those who have adopted the plan of keeping a journal of their experience, adapted to their particular business. The author has evidently spent much time and labor on experiments in order to produce the valuable information contained in the tables, some of which are the first ones ever printed on the subject. There is much original matter in this work; among those worthy of careful consideration is a new system of Arithmetic. The best authorities have been freely consulted, most of them being distinguished experimenters. This work is so thoroughly practical that a person does not require a knowledge of Algebra to understand the formulas; however, a little study is required in order to understand the plain characters used.

In writing a book of this kind it becomes necessary to use characters instead of words, otherwise the book would assume enormous proportions. The formulas contained in this book not only tell what is to be done, but at a glance convey to the mind a conception of the complete operation. The author has covered a vast area of ground, yet, each of the subjects under consideration has been handled in a very plain, practical way, and the work as a whole, bears the evidence of a persevering and careful search after truth. In designing and constructing compound engines, blowing machines, and fans, steam and rope traveling cranes, turbines and water-pressure engines, dynamometers for colleges, and general machinery, the author has met with extraordinary success.

By blending practice with theory the best results are obtained, and these features which characterize the above work, will, no doubt, ensure for it a still greater circulation.

CATECHISM OF THE LOCOMOTIVE. By Matthias N. Forney, M. E. Fourteenth Thousand. Published by the Railroad Gazette, 73 Broadway, N. Y. Contains 609 printed pages, 12mo. Cloth, price, $2.50.

The above book has already had an enormous sale among the railroad men of this country, for whom it was intended, and is, at the present day, doubtless, the most practical work on the locomotive in existence. The appearance of the work has been very much improved since its first publication, by the addition of a new style of cover, with appropriate decorations; also by the replacing of the original cuts of a locomotive, within the first cover, by an elevation and plan of an engine with all the modern improvements. Other little changes and corrections have been made which were thought necessary, and no pains have been spared to make this the leading book for all practical men on our railroads and in the shops. This work has for its foundation the essence of one of the best German books on the same subject, by George Kossak, which has been translated and enlarged upon to suit the American practice; besides, the best authorities have been freely quoted on all subjects bearing upon the construction and management of the locomotive. The book is written in the form of questions and answers, which is the best way to instruct the uninformed. The questions convey a very clear idea of what is meant, and are asked in a plain, practical way. This is the kind of reading matter that is sought after by the mechanic, and is prized more than any other. The only deviation from this rule has been the adoption of a few simple algebraic symbols, for the purpose of saving space, which will be easily understood. The movements of the slide valves and link motion are profusely illustrated. It also explains how to take a diagram which will show the operation of steam in the cylinder, pressure of steam at all points of the stroke, benefit of expansion, economy, etc. The locomotive is thoroughly described and many valuable suggestions given on the design and construction of boilers, riveting, strength of riveted joints, boiler attachments, all of which are of the latest designs. The best forms of cylinders, pistons and connecting rods are fully described, while the running gear is treated in a manner which is capable of being fully understood, to which is appended an exposition of some of the mysteries connected therewith. There follows a series of miscellaneous subjects relating to the care and management of machinery. The part on emergencies and accidents is worthy of more than a passing notice, for many a valuable man has lost his life either through his own ignorance or that of the bystanders. There is an appendix containing tables on steam, logarithms, fuel, resistance of trains, etc. This work is printed on good paper, clear type, and pleasant to read.

Business Specials.

Thirty cents a line for each insertion under this head.

The Huntoon Steam Governor Co., of Lawrence, Mass., warrant a direct saving in steam of from 10 to 20 per cent. over any other Governor known; while for quick and accurate regulation, great durability and lasting economy in use, they guarantee results never before attained by any other. See advertisement.

Brown & Sharpe M'f'g Co., Providence, R. I., keep in stock at reduced prices Patent Cutters for the teeth of gears which can be sharpened by grinding without changing their form. All wheels of same pitch cut with them will run together correctly. Send for new catalogue.

National Steam Pump, simple, reliable and durable. Send for illustrated catalogue with reduced price list. W. E. Kelly, New Brunswick, N. J.

Engine Lathes from 16 in. to 48 in. swing. Cuts Photographs and Prices furnished on application. A strictly first-class trial at a low figure. Geo. W. Fifield, Lowell, Mass., U. S. A., manufacturer.

Questions and Answers.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly and according to common sense methods.

(1) H. M. C., San Francisco, writes: There is a little question in regard to the running of engines, which I have heard discussed often, but without any definite conclusion, viz.: *Is there, and if any, what advantage is gained in wear or friction by having an engine run forward or backwards?*—that is, the top of the fly wheel running from or towards the cylinder.

I would like to hear your opinion through the "Questions and Answers" column, as a settler to the discussion. A. When an engine runs "over" the thrust of the connecting rod, both in the pull and push, as well as the weight of the cross head and attached parts, all comes on the lower slide, and hence might be thought to wear it faster. On the other hand, when the engine runs "under" the angularity of the rod forces the cross head against the top slide for the most of the stroke, and relieves the wear possibly. But near the ends of the stroke, when the rod is nearly parallel, the cross head etc. will drop back to the lower slide, from its weight, which is liable to make a disagreeable noise unless the gibs are set out pretty strong, and it is a question if this extra setting out of the gibs required is not more than an offset to any advantage there may be in running "under." At any rate, we have noticed that engines usually run better when running "over." Aside from the above, it is difficult to see what other points are involved. We invite information on the subject.

(2) J. C. B., Fall River, Mass., writes: I have been much interested in the discussion in the MACHINIST of engine performance, and the working of Indicators. I enclose a set of diagrams for your inspection. They were taken from a pair of Automatic cut-off Engines, Corliss pattern, Cylinders 28 x 60 ins.,

52¼ Rev. Steam furnished by plain cylinder boilers, connected with engines by about 50 ft. of 10″ pipe. Boiler pressure about 75 lbs. Consumption of Coal (a good quality of No. 2 Chestnut), 3¾ lbs. per 1 H. P. per hour. The point I wish particularly to call your attention to is the rapid and irregular falling off of the steam line before the cut off. Does this indicate a waste, and if so, what is the remedy? The valves at the time of cut off uncover less than one half the steam port. Please point out any other defects you may notice A. Your pipe is rather small for two engines. Your piston speed being over 500 ft., a 14″ pipe would be about right. Perhaps you have got a globe stop valve in the pipe; if so, put in a straight way. A very effect tive way to remedy a small pipe is to put in a reservoir of boiler iron at least the capacity of the cylinder, or larger, as near as possible to the engine. This gives a supply *near* the cylinder for it to draw on, and prevents the sudden jerky drafts on the pipe, which mean friction. The loss you speak of, however, is not serious. The half port is a very probable cause of the difficulty Can't you give the valve more travel in some way? We notice that the curve runs well,—in fact, unusually well, and the low economy which you mention, and which is poor for so large an engine, especialiy if condensing, is most likely due to the boilers. Try a water test, and we predict you will find low evaporation.

(3) H. G. A., Somerville, N. J., writes as follows: In your issue of August 2d, in Questions and Answers, I read a criticism by W. G. on your an swer to G. J. G's question, viz.: Which contains the most water, a cubic foot of steam at 10 lbs. pressure, or a cubic foot at 80 lbs. pressure? W. G. says in his statement that the quantity of water necessary to produce steam increases in exact proportion to the increased pressure of steam. He says one cubic foot of steam at 80 lbs. contains 6½ cubic inches of water. For the benefit of students I will give my mode of calculation. To the indicated pressure add the atmospheric pressure, divide the sum by decimal .491, which gives pressure in inches of mercury. The sixth root of the last result divided by .00564 minus 100 gives temperature of steam. To the temperature add 459, multiply by 76, and divide by pressure in mercury, and you have the volume of steam compared with the volume of water. By this calculation 80 lbs. steam contains 5.61 cubic water, and a cubic foot at 10 lbs. contains 1.645 cubic inches water.

(4) J. M., Cleveland, O., writes: An engineer here had a new boiler made under his instructions, and told the boiler maker not to test it. He said it was such a good boiler, and that it would hold 120 lbs. pressure of steam. It ran three years, when it began to leak in the sheet to which the dome is attached, a short distance below the foot of the dome. A hole was drilled in the sheet to insert a plug to stop the leak, when it was found so thin that it could not be tapped, consequently, he had to get a whole new sheet to replace the damaged one. Will you please give us your ideas as to what caused that sheet to be eaten away on the top of the boiler, like the case described? The water used is taken from the lake, and is heated, I am told, by one of Berryman's heaters. Please answer, and oblige. A. Your data is entirely inadequate to enable us to arrive at any definite results as to what could have been the cause of the corrosive action described. It would be necessary to make a critical examination of the water, the pipes and connections through which it is fed to the boiler, also the boiler and its construction, manner of setting, etc., without which we would not be able to give you a positive answer. You do not state as to whether the whole sheet was corroded, or only a small spot. If it was only a small space, we would say that it was probably caused by a blister in the iron. It is not safe to jump at conclusions in questions pertaining to the phenomena connected with steam boilers, as many of them are still a matter of speculation.

(5) J. D., New York, writes: You would oblige by answering the following questions: 1. I wish to know if a person of the age of twenty years would be too old to learn the trade of a machinist? 2. How long would it take such person to learn that trade? 3. How might he obtain a position as an apprentice at the same?

A. 1. No; for further advice, see answer to question 2 in our issue of February, 1879. 2. Some persons can never learn the machinist trade or any other. A person should first subject himself to a rigid examination, to see if he possesses the natural qualifications to enable him to succeed at the trade which he has selected. If satisfactory, such person ought to be able to become proficient in the use of tools and have a pretty thorough knowledge of the same at the end of a three years' apprenticeship. 3. Lose no time in making the acquaintance of some person whose influence will be successful in placing you in a good shop and helping you in your onward progress.

Another writer wisher to know: 1. If he is too old at the age of twenty years to learn the profession of a mechanical engineer? 2. Please name some good books upon the science of engineering, both land and marine, also upon Civil Engineering? 1. To learn mechanical engineering, see previous references. 2. A Practical Treatise on the Steam Engine, containing plans and arrangement of details for fixed steam engines, with essays on the principles involved in design and construction, by Arthur Rigg. 4to. 1 vol., half morocco, $17. Modern Marine Engineering, applied to paddle and screw propulsion, by N. P. Burgh, 403 pages. 4to., cloth $17. The above are considered the leading works on these subjects. For a course of mathematics, embracing all branches of engineering, the works of W. J. M. Rankine are used in the leading Institutes of Technology.

MANUFACTURES.

E. E. Garvin & Co., 139 Centre St., New York, have one of the most comfortable machine shops in this sweltering summer weather that we have visited. It occupies a large, well lighted and well ventilated floor at the top of a commodious building. They have a good force of skilled workmen upon milling machines, tapping machines, drills (from one to six spindles) and other machinists' tools. They have lately supplied considerable machinery to the Singer Manufacturing Co. and Domestic Sewing Machine Co.

The Contoocook Valley Paper Co., West Henniker, N. H., are resetting two boilers with the Jarvis setting.

Messrs. John Reardon & Sons, Cambridgeport, Mass., are setting a six foot steel boiler, built by Kendall & Roberts, with the Jarvis furnace, being their third order for this setting.

The Richard Borden M'f'g Co., Fall River, are setting a Corliss boiler on the Jarvis system.

The Concord, N. H., Axle Works have been working up to full capacity all summer on orders only, the production being larger than for several years past. The goods are distributed in all parts of this country, and some are being sent to foreign countries with prospects of an increased export trade.

Plans are being made for the construction of an additional water supply for the city of Rochester. A reservoir holding 1,000,000 gallons is to be built.—*Eng. News.*

The grist and planing mills at Panola, Ga., which were recently burned, are being rapidly rebuilt.

The people of Millville, Wabash Co., Minn., are talking up the enterprise of a large flouring mill.

The Shaw Stocking Co., Lowell, Mass., are about erecting a new factory 135x60 feet, three stories high. When completed it will employ about one hundred and twenty-five hands, and turn out 250 doz. pairs of hose per day.

The Northwestern Smelting Works, 36 Michigan st., Cleveland, Ohio, will, in a few days, extend their works by the addition of three new furnaces, increasing their capacity to one ton of metal per day.

The Hamilton Manufacturing Company, of Lowell, are now laying the foundation for their new mill, to be used in the manufacture of print cloths.

The oil firm of Charles Pratt & Company, are erecting four new stills with a capacity of holding 10,000 barrels of oil each, at their works on Bushwick Creek, Greenpoint, L. I.

The Taunton, Mass., Oil Cloth Works have commenced work on an addition to their factory which, when completed, it is said, will double the capacity of the establishment.

In a Bombay cotton factory, a man receives eight dollars a month, a woman four dollars, and a child two dollars and fifty cents.

S. H. Greene & Sons, of River Point, R.I., have added a 300 horse-power Buckeye engine to their works.

A large number of Chicago's manufacturing establishments are compelled, by growth of trade, to extend or enlarge their works. An addition is now being built at Tarrant's marine engine works. Gray & Clark are rebuilding and enlarging their tannery which was burned in June last. The Frazer Lubricator Company are erecting a new building and are doubling their facilities for manufacturing and storage.

The S. C. Huck Manufacturing Co. are making improvements at their establishment at Chicago to cost about $2,500. Conrad Kattentidt will soon build an $8,500 addition to his boiler manufactory.

A new pin-manufacturing company with a capital of $100,000 is being formed at Waterbury, Conn.

Farrell, Logan & Sons, boiler-makers, of Greenpoint, employ a large number of men in making oil-tanks, at Stone & Fleming's oil works, near Blissville, at $2.10 a day. Having been awarded another contract to make tanks for the Queens County Oil Works, they hired a gang of men from Philadelphia at $1.50 a day. When these new hands arrived yesterday the old hands refused to continue at work. At one time a riot was expected, but the more prudent of the old hands prevented it. A committee was appointed to talk with the firm.—*N. Y. Times, Aug. 7.*

The Nashua (N. H.) File Works write us their business is increasing rapidly. They employ 10 men, full time, and not being able to turn out work fast enough will increase their working force.

The New England Novelty Works, Hill, N. H., are running full time with orders ahead. Their foreign trade is steadily increasing, a large number of tools being shipped each month to England and other countries. Their home trade has been good all through the hard times, and the future looks bright. Power is furnished by a ten H. P. engine.

The new device for lubricating shafting and bearings of all kinds, now being introduced by W. J. Faul & Co., 218 Centre St., New York, is giving a good account of itself wherever it is in use. The lubricant used is the result of a series of experiments undertaken for the purpose of procuring a lubricating compound superior to anything heretofore employed. A single cylinder of this lubricant lasts from ten days to six months according to the velocity of the shaft. One of the admirable features of this device is that it does away with the uncleanly drip-pan, but one thing that will make it especially popular is its cheapness.

Hollingsworth & Whitney are building an addition to their paper mill at Watertown.

Totten & Co., Pittsburgh, Pa., have just received their fifth recent order from England for machinery. Their chief demand for the English market is for nail machines for cutting both iron and steel, and for hollow chilled rolls.

The Keystone Bridge Works, Pittsburgh, Pa., have started to run night and day. They are very busy just now, having a large number of orders from every part of the United States on hand. Employ 300 hands.

At the Cincinnati Exposition a premium of $500 will be awarded for the best smoke-consuming boiler, to be exhibited anywhere in Cincinnati, Covington, or Newport; the condition being that there be two competitors, that the device be cheap, efficient and economical. Also, a premium of $300 for a device for a smoke-consuming stove or grate for domestic use, to be put up anywhere in Cincinnati, Covington, or Newport, or in the Exposition Building.

A new steam mill is projected at Olivia, Minn.

Allen & Endicott, machinists, Cambridgeport, have sunk a well 112 feet, and use its cool water instead of iced Fresh Pond water.

It is reported that an English manufacturer has lately been prospecting along the line of the Hudson river for the site of a linen mill, which it is proposed to remove from England, and which will employ 2,000 hands.

Tucker & Cook have begun rebuilding their cotton mill at Conway, N. H., on a considerably larger scale than before.

W. H. Lathrop & Co., of Willmantic, Ct., are making extensive improvements in their establishment, and will put in steam power.

The erection of a blast furnace is proposed at Chambersburg, Pa.

Messrs. Barclay & Ruggles, of Escanaba, Wis., will build a mill in Green Bay, near the Escanaba Furnace.

The Minneapolis millers made quick work of taking the $100,000 capital stock in the new half-million bushel elevator to be erected at once for the new crop. The stock was all taken in one day in blocks of $5,000 and $10,000.

It is currently reported that an iron foundry will shortly be established at Parrsboro, N. S.

Juan G. Ribon, Jersey City, N. J., is very busy at present. Has lately shipped a coffee dryer, 16 feet diameter, 16 feet long; also one 6 feet diameter, 4½ feet long, and is making two, 6 feet x 6 feet. One of these is to be sent to Java, and is the first of this kind of machinery ever shipped there from this country. These machines are made under the patents of Jose Guardiola, Guatemala, S. A. The above party is also making eight coffee wheelbarrows and one coffee pulper, besides a ten-stamp battery for the United States of Columbia, S. A. The coppersmith department is busy, making three copper pans for boiling sugar, sugar machinery for Matthiesen & Wiechers, also some machinery for the Ink Works, Jersey City, N. J.

Jas. Brahm, Jersey City Iron Works, is making a new danger signal, applicable to a switch with interlocking attachment, also crossing signals for the Long Island Railway. He is also introducing a new switch with main track unbroken, which, if left open through carelessness, is thrown right automatically by the wheels of the train in passing over it. It is said to possess other important improvements. This concern is also manufacturing frogs and crossings. Has issued a new catalogue.

The Smith Lock Nut Co., of 113 Liberty Street, New York, are introducing a new lock nut which seems to give satisfaction. It is used principally for railroad fish plate joints.

A contract for one hundred iron bridges for Costa Rica, S. A., for the road from Punta Arenas to San Jose and thence to Port Limon, has been awarded to Mr. Charles Snyder of Patterson, N. J. They will be constructed in various Pennsylvania and New Jersey bridge building establishments, and they must be in position by January 1.

A company proposing to expend $250,000 in the erection of a factory, and plant it at Moncton, N. B., for the manufacture of locks, rolled brass, brass wire, and other builders' hardware has just received a grant from the Town Council, according to the *Times*, of exemption from all taxation for ten years to come.—*Montreal Journal of Commerce.*

The Fall Mountain Paper Company of Bellows Falls, Vt., are about to commence the erection of a new mill.

C. H. Read & Co., Allegheny, Pa., have commenced the manufacture of steel castings under the Seymour Rogers process. They are going into this business largely, and have excellent facilities for producing castings of best quality.

Hancock Inspirator Co., Boston, Mass., are full of orders, employ forty hands, and are kept very busy.

Armington & Sims, Lawrence, Mass., are very busy, and running full time.

Geo. W. Fifield, Lowell, Mass., is kept very busy, and running on over-time. He has orders for his Engine Lathes, which he is just shipping to Wisconsin, Illinois, Indiana, Connecticut, New Hampshire, Massachusetts, Ohio and New York State.

The Ames Manufacturing Company, Chicopee, Mass., have during the past year made large shipments of gun machinery, lathes, etc., to Japan and Sweden.

Situation Wanted—Help Wanted.

We will publish notices suitable for the above headings, applying to any of the machinery trades, and not to exceed four lines each (32 words), at the nominal rate of twenty-five cents for each insertion.

WANTED.

First-class Boiler Maker wishes a situation. Competent to take charge of any kind of Boiler or Bridge work. Address, J. Whitty, Paterson, N. J.

WANTED.—A first-class Moulder for a jobbing shop. Steady employment to a sober, competent man. Address, with references, F. D. Livermore, Rochester, Minnesota.

WANTED.—A copy of No. I, Vol. I, of the AMERICAN MACHINIST to complete my file. Will pay 50 cents for it if clean enough to bind. Address, Wm. Brunner, No. 169 Adam St., Hoboken, N. J.

Machinists' and Engineers' Supplies.

Trade is brisk in standard specialties, and manufacturers are driven to their full capacity. The increased demand from railroads, and from new shops just starting, has given fresh activity to the trade as well as the multiplying demand from foreign countries, especially from Great Britain, where American tools are working more into favor every day. The chances are that the coming Fall will witness a better trade in machinists' specialties than for several years past.

The Brown & Sharpe Mfg. Co., Providence, R. I., are manufacturing a new hair clipper for barbers' use. It has a number of shearing plates, thick enough to allow of repeated sharpening. The instrument has a steel spring to throw out the handles when released, after being pressed together, and will operate very rapidly and neatly. Prices as follows: No. 1, $5.00, No. 2, $5.50, and No. 3, $6.00, each. They will be sent by mail on receipt of price and 15 cents for postage.

We have received from the N. Y. Belting & Packing Co. a copy of their new price list of vulcanized rubber fabrics adapted to mechanical purposes, also a reduced price list of their Solid Emery Vulcanite Wheels. It is a 16 page pamphlet, and will be mailed to any one in the trade upon application.

W. S. Middleton, 52 John St., N. Y., reports a large increase of orders from San Domingo and So. American countries for machinists', engineers', and railroad supplies. He finds a difficulty in filling many of his orders, by reason of having to wait considerable time for the manufacturers to produce the goods, as they are most of them crowded with orders ahead.

Peter A. Frasse & Co., 95 Fulton St., New York, are just introducing Hall's Patent Double Compound Lever Cutting Nippers, which are very neat, handy, and powerful. They will cut steel or iron wire with the exertion of astonishingly small power. The following are the points claimed for these nippers: 1st. Increased power without a clumsy and expensive increase of size. 2nd. The construction is such that any damage to the cutting jam, or handle, from wear, or accident, can be repaired. All the parts are interchangeable. They are made of a fine quality of steel, the parts being drop-forged. The accidental fracture of any part does not render the tool worthless, as a new part can be obtained to take its place at the cost of a few cents. The tool is sold at $1.25, with a liberal discount to the trade.

The recent advance in the prices of Iron Pipe, and Brass and Iron Steam Fittings, instead of causing orders to drop off, has operated as a tonic to business, stimulating orders to an extent never before known at this hot season. As iron is advancing almost daily, consumers may expect to hear, at any moment, of a further advance all around the line.

In fact, one house, the Eaton, Cole & Burnham Co., announce another advance as already decided upon, to apply to everything on the docket and to take effect August 15th.

Customers no longer ask: "What's the price?" but instead, propound the familiar conundrum, "How soon can you ship?" shows price to be a secondary object. Furthermore, manufacturers, dealers and consumers, alike, seem equally pleased with the idea of an advance in prices, as it tends to show a better state of things.

While there is no combination among makers of brass and iron goods, manufacturers generally seem all of one mind about prices, every maker putting up his own prices to suit his own notion, without regard to what his neighbors are doing.

The manufacturers of Brass and Iron Fittings have all agreed to make a reasonable charge for boxing and carting, hereafter, without exception.

W. S. MIDDLETON,
BROKER IN
Railroad, Mining and Steamship Supplies,
MACHINERY, HARDWARE AND TOOLS
of every description.
52 JOHN STREET, NEW YORK.
☞ Manufacturers of Machinists', Engineers', Railway and Mining Supplies of every kind are requested to send me their latest catalogues and trade prices.

PATENTS
F. A. LEHMANN, Solicitor of Patents, Washington, D.C.
NO PATENT NO PAY. *Send for Circular.*

NORTON'S
Solid Emery and Corundum Wheel.
The Best Solid Wheel in use. Will not Glaze, Heat, nor smell, and will run equally well, Wet or Dry.
SATISFACTION GUARANTEED OR NO PAY.
F. B. NORTON, Patentee and Manufacturer,
No. 41 Water Street, Worcester, Mass.

THE·STOW·FLEXIBLE·SHAFT·CO·LIMITED·
As this shaft transmits power through any number of curves, its value in the railroad and general machine shop, is at once apparent. We have designed, and keep in stock, a series of special tools for use with the shaft, as: PORTABLE DRILLS for metals; AUGER CHUCKS for wood; CLAMPS for emery and buffing wheels, etc. CATALOGUE and PRICE LIST, on application
500·NORTH·FIFTEENTH·ST·PHILADELPHIA.

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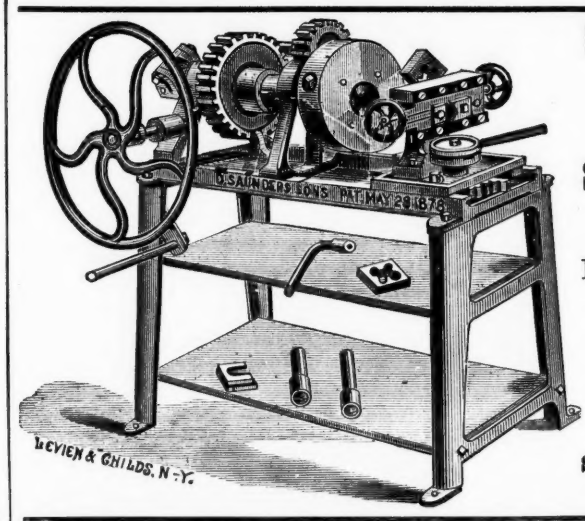
SOLE MANUFACTURERS OF
FILES AND RASPS
HAVING THE INCREMENT CUT.
Also, FILERS' TOOLS and SPECIALTIES.
"Nicholson File Co's" Files and Rasps.
"Double Ender" Saw Files.
"Slim" Saw Files.
"Racer" Horse Rasps.
Handled Rifflers.
Machinists' Scrapers.
File Brushes, File Cards.
Surface File Holders,
Vise File Holders.
Stub Files and Holders.
Improved Butchers' Steels.
Manufactory and Offices at **PROVIDENCE, R. I., U. S. A.**



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Yonkers, N.Y.,
Manufacturers of
Steam and Gas Fitters'
TOOLS,
Pipe Cutting & Threading
MACHINES
For Pipe Mill Use, &c.,
A SPECIALTY.
Send for Circular, and say where you saw this advertisement.

STEEL CASTINGS
FROM 1-4 TO 10,000 lbs. WEIGHT.
True to pattern, sound and solid, of unequaled strength, toughness and durability.
An invaluable substitute for forgings or cast iron requiring three-fold strength.
Gearing of all kinds, Shoes, Dies, Hammerheads, Crossheads for Locomotives, etc.
12,000 Crank Shafts of this steel now running proved superior to wrought iron.
CRANK SHAFTS, CROSSHEADS and GEARING specialties.
Circulars and Price Lists free. Address
CHESTER STEEL CASTINGS CO.
Works, CHESTER, Pa. — 407 Library St., PHILADELPHIA.

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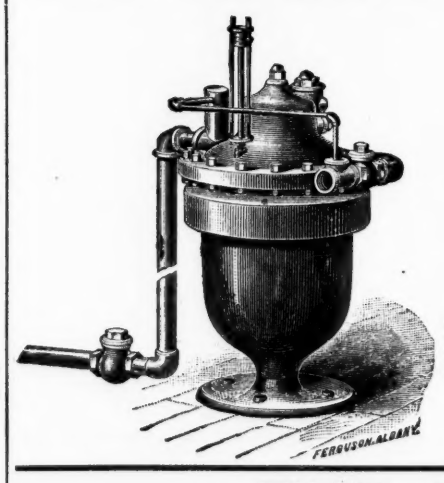

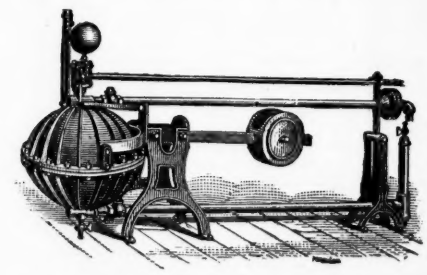

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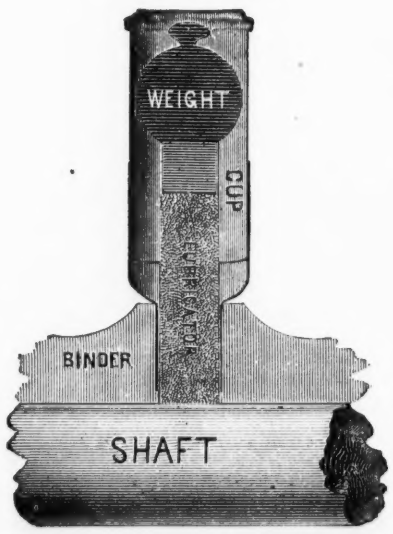

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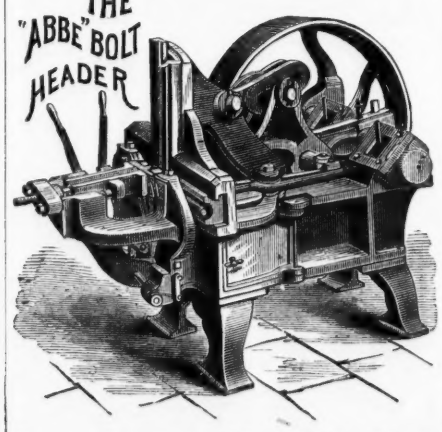

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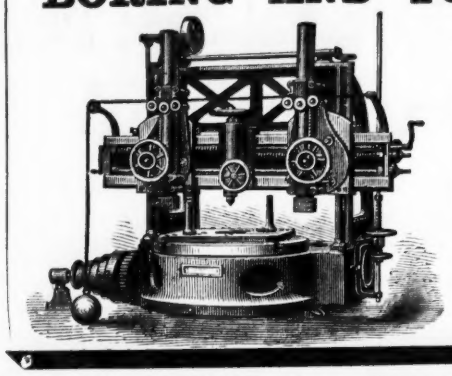

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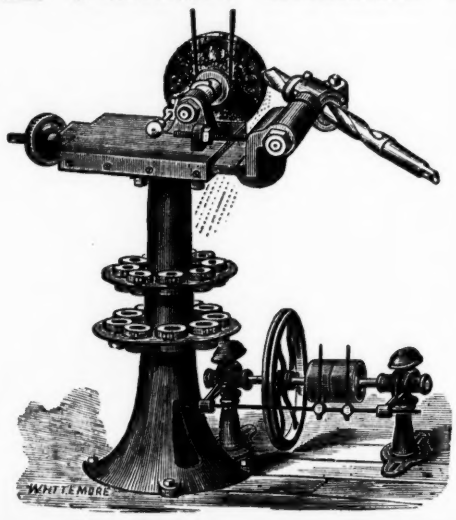

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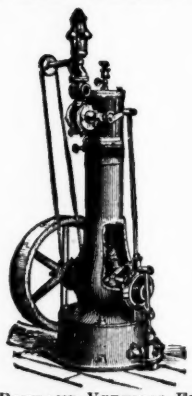

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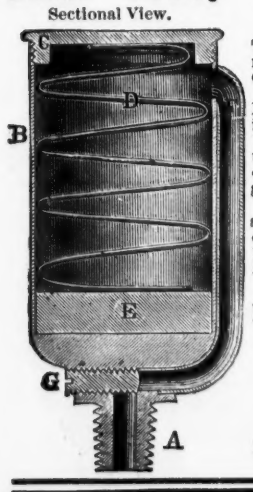

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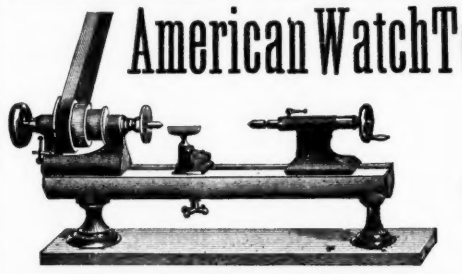

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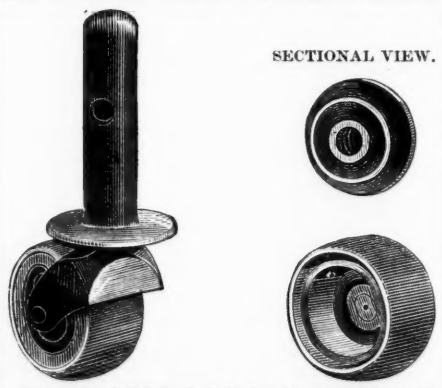

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At this writing we are not able to announce definitely any change in our last quotations, but that there will be a change soon, and that in the direction of a further advance, we have every reason to believe. The change is in the air; but until it actually comes we are unable to forecast the market, even for a day, as matters stand at the present moment. As intimated last week, just the state of affairs exists that makes it wise for any one with future obligations to cover now. The mills are all full of work, many of them for months ahead, and orders are placed with difficulty for any reasonable delivery.

The rates out of store continue as below: No. 1X Pig Iron $19.50 per ton; Iron Rails, $42.00 to $44.00 per ton, according to weight; Old Rails, $25.00 to $26.00 per ton; Fish Plates, $2\frac{2}{10}$c. per lb.; Railway Spikes, $2\frac{3}{4}$c. per lb.; Bolts and Nuts, $3\frac{1}{2}$c.; Common Iron, 2c. basis from store; Refined, $2\frac{2}{10}$c. basis; Ulster, $3\frac{1}{2}$c. basis; Machinery Steel, 5c.; Best Tool Steel, 12c.; Norway Bar Iron, $4\frac{3}{4}$c.; Norway Shapes, $5\frac{1}{4}$c.; Nail Rods, $5\frac{1}{2}$c.; Sheet Iron, $2\frac{8}{10}$c.; Angle Iron, $2\frac{6}{10}$c.; Tee Iron, 3c.; Band Iron, $2\frac{5}{10}$c.; Hoop, $2\frac{7}{10}$c., up; Horse Shoe, $3\frac{1}{10}$c.; Tank, $2\frac{6}{10}$c.; C No. 1, $2\frac{3}{4}$c.; C H, No. 1 Shell, 3c.; Best Flange, $4\frac{3}{4}$c.; Boiler Rivets, $3\frac{1}{2}$c. per lb. Hot Polished Shafting in lengths two feet and longer, from 5 to 6c. per lb., according to size. Small Black Rivets, 50% off in papers, 35% off in bulk.

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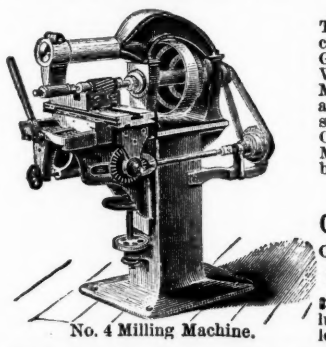

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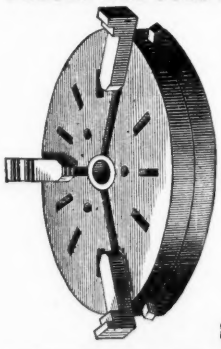

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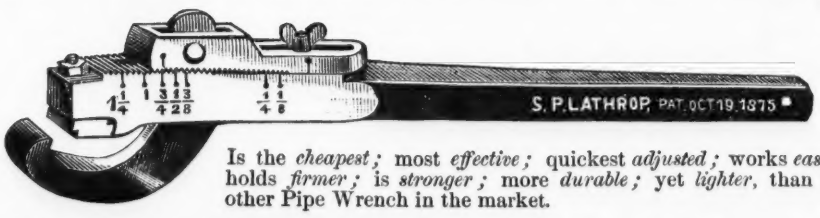

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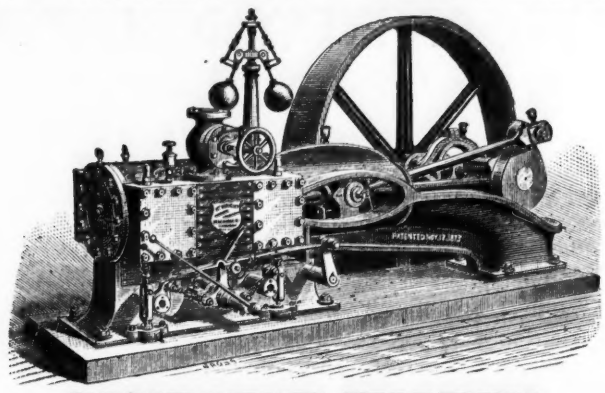

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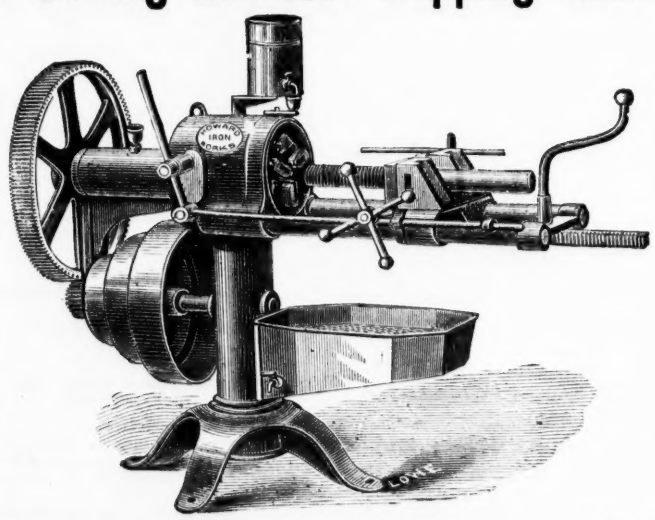

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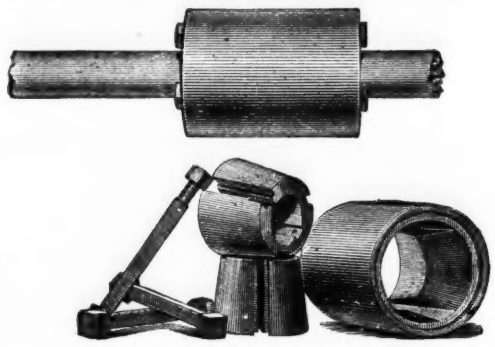

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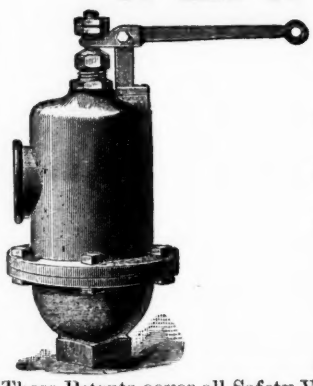

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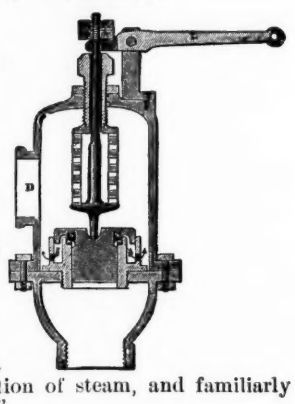

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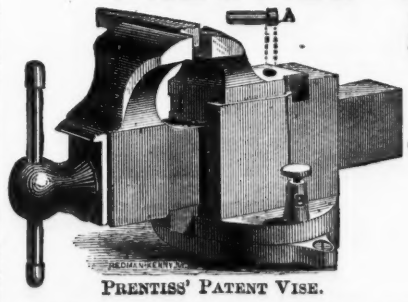

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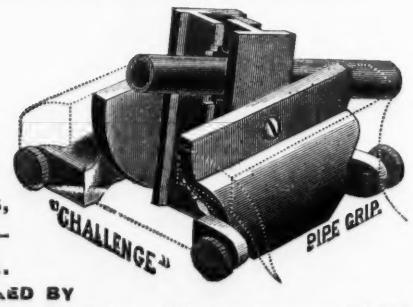

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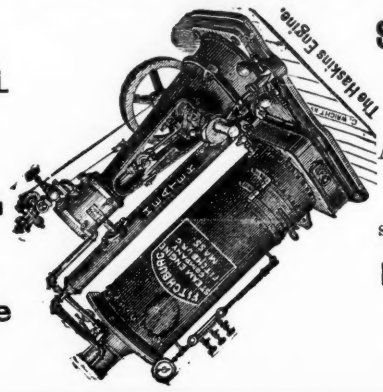

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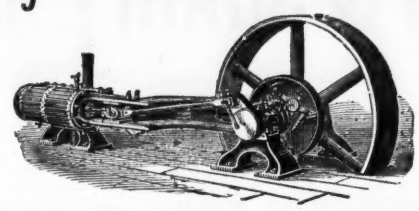

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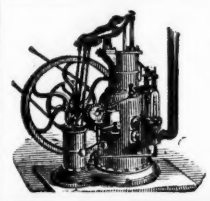

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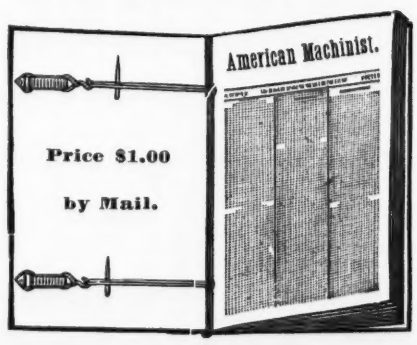

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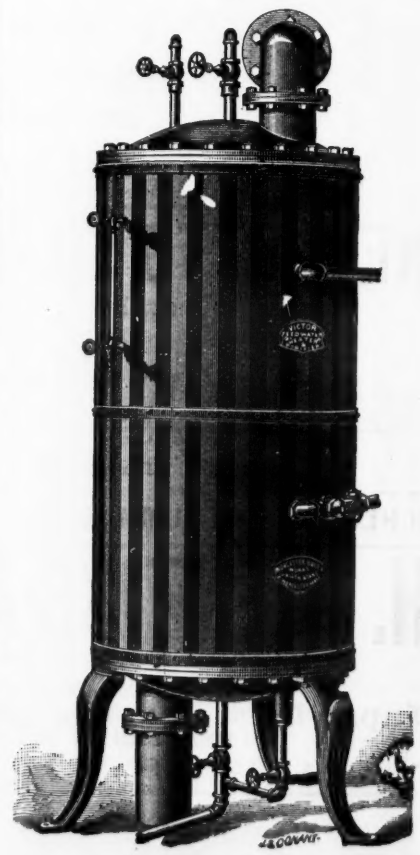

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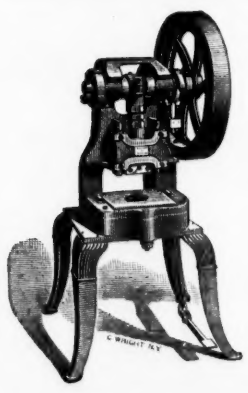

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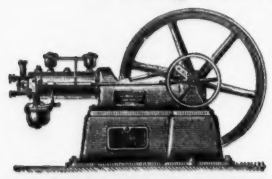

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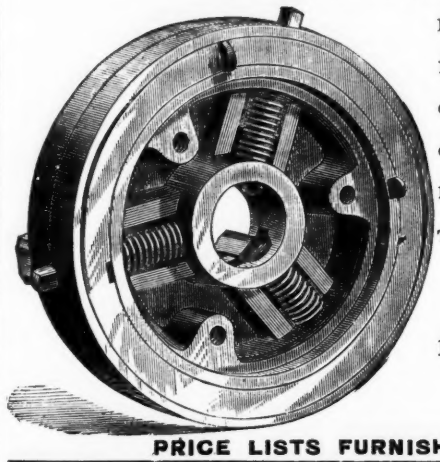

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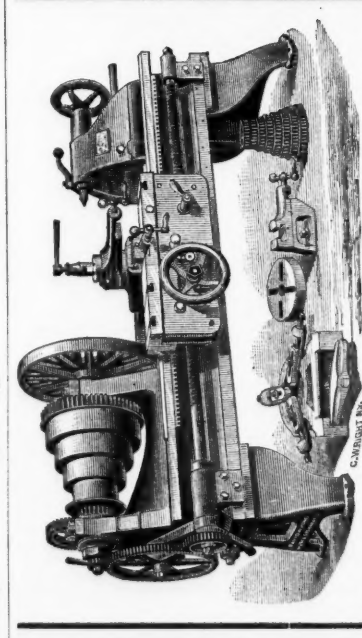

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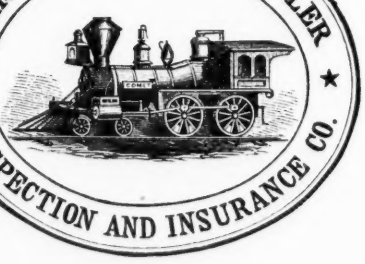

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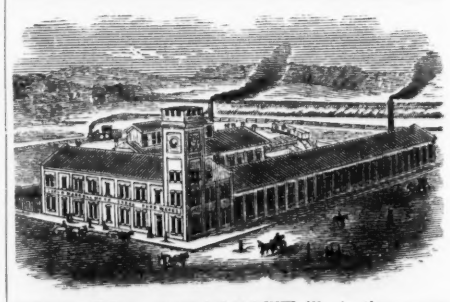

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